An aerial photograph of an oil tanker ship docked at a pier. In the foreground, a large white storage tank is visible. The ship is dark-colored with a white hull. The pier is made of concrete and has several pipes and structures. The water is dark blue.

# **Petroleum Quality Information System Aviation Fuels Data**

**1998**



IN REPLY  
REFER TO

**DEFENSE LOGISTICS AGENCY**  
DEFENSE ENERGY SUPPORT CENTER  
8725 JOHN J. KINGMAN ROAD, SUITE 4950  
FORT BELVOIR, VA 22060-6222

10 April 2000

**PETROLEUM QUALITY INFORMATION SYSTEMS JET FUELS DATA (1998)**

This is the third annual report summarizing test results of aviation fuels received in calendar year 1998 with comparison statistics starting from calendar year 1995. Test result data is stored in our Petroleum Quality Information System (PQIS) Database which currently contains 6473 records, representing over 9.1 billion gallons of jet fuel, starting from January 1, 1995 and continuing through the end of calendar year 1998.

The first report was published in June 1998 and covered data for years 1990 - 1996. Data was summarized to provide statistical information on average, minimum and maximum values of selected test properties for use by our customers in researching specification or quality issues. The second report was published in December 1998 and summarized data for jet fuels manufactured in 1998 with statistical information presented for calendar years 1995 - 1997.

Comments and questions pertaining to this report and recommendations for future reports are welcome. Please contact Mr Kenneth Henz at Commercial (703) 767-8356 or DSN 427-8356, e-mail [khenz@desc.dla.mil](mailto:khenz@desc.dla.mil).

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Olefins	<b>5</b>	34	<b>6</b>	35
Total Sulfur	<b>7</b>	36	<b>8</b>	37
Mercaptan Sulfur	<b>9</b>	38	<b>10</b>	39
Particulate Contamination	<b>11</b>	40	<b>12</b>	41
Filtration Time	<b>13</b>	42	<b>14</b>	43
Total Acid Number	<b>15</b>	44	<b>16</b>	45
Smoke Point	<b>17</b>	46	<b>18</b>	47
Naphthalenes	<b>-</b>		<b>19</b>	48
Hydrogen Content	<b>20</b>	49	<b>21</b>	50
Distillation 10% Recovered	<b>22</b>	51	<b>23</b>	52
Distillation Final Boiling Point	<b>24</b>	53	<b>25</b>	54
Flash Point	<b>26</b>	55	<b>27</b>	56
Cetane Index	<b>28</b>	57	<b>29</b>	58
Net Heat of Combustion	<b>30</b>	59	<b>31</b>	60

## **Section 1 – Executive Summary**

This report provides a summary of the quality of aviation fuels purchased for U.S. Department of Defense (DoD) in calendar year 1998, based on actual submitted test data describing the vast majority of these fuel shipments. This is the third such report since the first (1990-1996) and second (1997) reports were published. Overall and regional trends for selected fuel properties are documented in the current report for the period 1995 through 1998. Based on reported test data, the total sulfur and olefin content of JP-5 jet fuel are not driven by DoD specification limits for these properties. The olefin limit was in fact deleted from the U.S. JP-4, JP-5 and JP-8 specifications in late 1998/early 1999.

Information published in this report is obtained from the Petroleum Quality Information System (PQIS). The Office of the Secretary of Defense, Energy Policy Directorate, authorized the establishment of this database in 1989. The purpose of this automated system is to standardize the level of test data available to electronic access, to track trends in product quality and to address quality issues. Initial implementation of PQIS began with aviation turbine fuel grades JP-4, JP-5 and JP-8 procured for the military in 1990. Corresponding NATO codes for these product grades are F-40, F-44 & F-34. Next year the report will be expanded to address the quality of ship's diesel fuel (NATO Code F-76).

Within this report, histograms show the distribution of 1998 test data by the volume of fuel that is represented. Tables in the Appendix document statistical summaries of minimum, average, volumetrically weighted average and maximum values for selected test properties based on the geographic source of the fuel. Regions 1 – 5 correspond to U.S. Petroleum Administration for Defense Districts (PADDs), with PADDs 1-5 denoting portions of the United States. Properties of fuels supplied from outside the U.S. are reported under Region 6 (the Middle East), Region 7 (Europe) or Region 8 (Pacific).

An extensive effort was made to insure the completeness of test information upon which this report is based. With the assistance of the Defense Contract Management District (DCMD) field offices, this effort resulted in greater than 90% representation of aviation fuels procured for the military services and greater than 85% representation of JP-5 jet fuel procured for the U.S. Navy.

Military specifications were used to procure these aviation fuels for the U.S. government. Therefore, the trends noted in this report may not necessarily reflect those seen in industry, since the military fuels are in some cases specially blended to meet U.S. government requirements.

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## **Section II - Introduction and General Information**

### **Background**

In 1987, the Logistics Management Institute (LMI) published a report entitled “*Petroleum Quality Information System (PQIS): Architecture and Design Alternatives*”, which outlined system requirements and alternatives for a system that would store and process information on the quality of petroleum products procured and used by the Department of Defense (DoD). In February 1988, the Office of the Assistant Secretary of Defense, Energy Policy Directorate, made a request for review and comment on this LMI report to the Services. Responses collected from March - May 1988 clearly established the need for a comprehensive system to track quality trends and to have a standardized method of entering in data electronically. As a result of the survey, the Defense Energy Program Policy Memorandum (DEPPM) 89-1, dated 25 April 1989 was issued which established the requirement for PQIS and designated the Defense Fuel Supply Center (now DESC) as responsible for designing the PQIS. PQIS was planned as an automated mainframe information management system that would standardize dissimilar government and private sector quality control and surveillance data reporting formats into a standardized format. The information in the database would be available to DoD personnel for use in identifying, investigating, and resolving fuel related equipment problems.

The DEPPM 89-1 authorized LMI to develop a prototype to be tested and evaluated by DESC. The review was completed in March 1989. Because of funding constraints and the complexity of designing an all-encompassing system, the initial PQIS database system was designed around procurement of aviation fuels (JP4, JP5 and JP8). This prototype PQIS system was put into operation in October 1990 using a desktop PC-Based (in DBase IV) program. The first report entered into the database was dated 25 Sep 90. Since that time, the database program was converted to Access 2.0, then Access 7.0 and now Access 97. Test reports received from contractors worldwide were entered into the database. Plans in the near future are to expand the system to include test results from the procurement of other fuels and quality surveillance data.

The first survey report was published in June 1998 which provided statistical information on data from calendar year 1990 to calendar year 1996. The second survey report was published in December 1998 and provided information from calendar year 1997. This report is a continuation of these prior survey reports, using the same formats for Histograms and Tables to facilitate comparison with information from the previous reports.

Upon completion of the initial report, all test results for calendar years 1990 – 1994 were archived and test results starting from 1 January 1995 were kept in the active database. Because of the low percentage of product volume in PQIS versus product purchased reflected in *Chart 2* of the 1990–1996 PQIS Report, a special effort was made to increase the representation of the volume by requesting the test reports not originally submitted. Volumes in PQIS were analyzed against a listing of known receipts and a list of missing reports by contractor was sent to the Defense Contract Management District (DCMD) field offices to gather and submit the missing data.

The response of DCMD, as for the previous PQIS Report, was overwhelming. All of the data for JP4 purchased in fiscal years 1996 through 1998 is represented in the database. For fiscal year 1997, the representation of JP5 increased from 97% to 99% and the representation of JP8 increased from 70% to 90%. Through the efforts of DCMC, the amount of product represented in the database increase by 0.8 billion gallons of JP5 and JP8.

The contract delivery period may cross the calendar year ending date. For example, at the start of fiscal year 1997, deliveries were made in 1997 for contracts let in 1996. Therefore, to assess contractor compliance in *Chart 2*, the data was grouped by fiscal year of the contract. However, the histograms and tables in the Appendix are based on calendar year grouping of data, because it is easier in Access to do this grouping rather than a fiscal year grouping. For the fiscal year 1995 percentage data, all deliveries made from fiscal year 1994 contracts and prior contracts which were delivered in 1995 are included in the fiscal year 1995. Similarly, one fiscal year 1998 contract had a delivery towards the end of 1997 and is included in the calendar year data for 1997.

## Summary Information

Using the test report date as the basis for the calendar year grouping, the data in the PQIS database for 1998 represents **2,193 data points** for a total of **2.84 billion gallons** of AN8, JP4, JP5 and JP8. Chart 1 below shows number of shipping tank reports and the volumes represented (in millions of gallons) for each year covered by this report.

### Chart 1

## Total Jet Fuel Entries by Calendar Year

(Volume in Millions of Gallons)

Fuel	1995		1996		1997		1998		Total	
	Volume	Number	Volume	Number	Volume	Number	Volume	Number	Volume	Number
AN8			9.11	6	3.20	3	3.39	1	15.7	10
JP4	67.10	139	0.89	6	1.64	9	1.71	10	71.34	164
JP5	87.22	41	494.45	160	707.32	252	615.81	230	1904.80	683
JP8	992.81	738	1831.80	1231	2142.56	1695	2228.68	1952	7195.79	5616

The above data in Chart 1 indicates number of test reports for each individual shipping tank used to sell product to DESC per Contract Line Item Number (CLIN) for each contract, not the number of shipments made. A single product movement may involve more than one shipping tank, just as many product movements (e.g., truck shipments) could have the same source tank. The quantity shipped from each tank is meant to indicate actual quantity shipped to the US Government under DESC contract at a refinery or terminal from a particular shipping tank, not the total quantity in the tank at the time of sampling. Thus, this database represents what was actually delivered to DESC customers. The quantity reported on the test report from each shipping tank is the basis for calculating the volumetrically weighted average (See "Use of Terms", page 8, for the definition of volumetrically weighted average) for a specification property.

Included in Chart 1 for this year's report is test result data for a special aviation fuel procured for use in the Antarctic with the product code of "AN8". Since this product is purchased only once during the year and the amount procured is small compared with the other aviation fuels, it is omitted from the Histograms in **Section III** and Charts in the **Appendix**. However, Chart 8 displays minimum, average, volumetrically weighted average and maximum values for selected test properties for AN8 for years 1996 through 1998 (a total of 10 reports representing 15.7 million gallons). Similarly, since 10 reports were received in 1998 for JP4, the statistical summary for selected specification properties is presented in Chart 7. Data for JP4 is also omitted from the Histograms and Charts.

Chart 2 shows the representation of the volume of product reported for inclusion in PQIS versus the amount actually purchased. Each contract number contains a segment which indicates the fiscal year in which the contract was awarded. With contracts grouped according to the fiscal year in which they were awarded, the DFAMS printout for each contract line item was compared, order by order, to the quantity represented in PQIS. Since an order can be made in December and delivered in January, grouping delivery periods can extend across calendar year lines, the fiscal year was chosen as the basis for the comparison in lieu of calendar year. Volumes in Chart 2 represent information on complete specification results on the aviation fuels JP4, JP5, and JP8 on a *world-wide* basis focusing on what was shipped to DESC customers.

## Chart 2

Chart By <u>Fiscal Year</u> of Volumes Reported and Percentage of Total Volume Purchased (Millions of Gallons)				
<b>JP4</b>	<b>1995</b>	<b>1996</b>	<b>1997</b>	<b>1998</b>
Reported	66.9	1.6	1.5	0.8
Purchased	117.2	1.6	1.5	0.8
Difference	50.3	0.0	0.0	0.0
Percentage	57%	100%	100%	100%
<b>JP5</b>	<b>1995</b>	<b>1996</b>	<b>1997</b>	<b>1998</b>
Reported	186.4	670.2	696.3	338.0
Purchased	986.5	771.0	702.7	393.1
Difference	800.1	100.8	6.4	55.1
Percentage	19%	87%	99%	86%
<b>JP8</b>	<b>1995</b>	<b>1996</b>	<b>1997</b>	<b>1998</b>
Reported	686.9	1896.8	2309.6	1155.9
Purchased	3137.3	2343.8	2577.0	1277.5
Difference	2450.4	477.0	267.4	121.6
Percentage	22%	81%	90%	90%

Although the percentage of JP5 represented for 1998 is 86%, the amount missing amounts to 55.1 million gallons, equating to about 9 - 10 tanker shipments of JP5, which were not received in time to be included in this report. A great majority of the missing JP8 data comes from tank truck shipments and/or small pipeline shipments, some of which have shipping document information but no corresponding test report. Efforts will continue be made to collect this information and include it in the database for future use, as it becomes available.

Chart 2 reflects the decreasing amount of fuel purchased from Bulk Fuel Contracts as fuel terminals are closed, authorized storage levels decrease, and the military draws down. This trend is especially noticeable from 1997 to 1998.

The ability to group the world-wide data contained in this report into geographical areas (e.g., Europe, Western US, etc) may be desirable in order to provide a more specific or focused analysis of data for a particular area of interest. For example, a researcher may want to know how the sulfur results vary for the West Coast of the United States versus the East Coast. To assist in this regional type of analysis of characteristics of fuels purchased by the US Government, "regions" were assigned to each state in the United States and geographically in overseas areas. These "regions" are defined in Chart 3, which divides the continental United States along the same lines as the PADDs (Petroleum Administration for Defense Districts).

Since the end of World War II, the Petroleum Administration Districts (PADDs) were used by the Department of Energy to divide the United States into regions for use in statistical analyses (mainly price factors) as a common baseline for calculating and reporting. The use of the PADDs in this report provides the advantage of using an existing common industry reference for comparative statistical purposes.



### Chart 3

#### Regional Assignments for PQIS Report

PAD		Title	States or Countries
Region	District		
1	I	East Coast	ME, VT, NH, MA, RI, CT, NY, PA, NJ, DE, MD, VA, WV, NC, SC, GA, FL
2	II	East Central	ND, SD, MN, IA, NE, WI, MI, OH, KY, TN, IN, IL, MO, KS, OK
3	III	Gulf Coast	AL, MS, AR, LA, TX, NM
4	IV	West Central	MT, ID, WY, UT, CO
5	V	West Coast	WA, OR, CA, NV, AZ
6		Middle East	Kuwait and Bahrain
7		European	Europe, Israel and Turkey
8		Pacific	Korea, Japan, HI, AK and Australia

#### Use of Terms

The terms used within this report are defined as follows:

- a) **Spectender** - A complete specification analysis report of product being offered for acceptance by the US Government. For fuels, it is the written report of results for full specification testing in the refinery or terminal shipping tank for product offered for acceptance.
- b) **Report** - Represents one spectender tank test result (Complete Specification Test Results), regardless of how many shipments were made out of the tank or if more than one tank was involved in a total loading or product movement.
- c) **Volume** - Total volume, expressed in millions of gallons, delivered to the US Government or other designee from the shipping tank referenced in the report.
- d) **Region** - As defined in Chart 4, refers to the grouping of states and countries based in the continental United States on the PADDs. These regions do not correlate with the Defense Fuel Regions or Offices. Since shipments can originate and terminate in different regions, the determination of the region was chosen based on the refinery location rather than the receipt location.
- e) **Average/Volumetrically Weighted Average** - The average calculated on volume of fuel purchased rather than each instance of purchase. For example, if one batch of product had an API Gravity of 46.0 with 1,000,000 gallons delivered and another batch had an API Gravity of 43.5 with 500,000 delivered, the **average**, based on occurrences of test values, would be:

$$(46.0 + 43.5)/2 = \underline{44.75}.$$

The **volumetrically weighted average**, based on volumes of product represented by the test values, would be:

$$(46.0 \times 1,000,000) + (43.5 \times 500,000) / 1,500,000 = (67,750,000 / 1,500,000) = \underline{45.17}$$

The difference between the two averaging methods is 0.42°API. Each method uses a different basis to calculate the average. Both averages are provided in this report.

## Summary of Data by Region

The next three charts provide a breakdown of the total number of reports received per Region and a further breakdown of both the volume and number of reports received for each product grade. *Chart 4* below indicates the total number of aviation fuel test reports received, by year, from each region as an aid for the reader in evaluating data presented in this report. Clause E40.05, *Material Inspection and Receiving Report*, cited in DESC contracts, requires our contractors to send in a copy of the complete laboratory test reports from each shipping tank used for shipments to DESC Customers.

### Chart 4

## Total Reports Received by Year and Region

Region									
Year	1	2	3	4	5	6	7	8	Total
1995	30	83	349	150	154		30	122	918
1996	60	148	544	96	242	10	133	171	1403
1997	97	306	787	86	360	10	111	202	1959
1998	150	272	997	112	350	6	77	229	2193

The values above represent the number of possible data points available for each region for all of the JP4, JP5 and JP8 received for that year and were entered into the PQIS database. Again, the number of occurrences do not directly relate to the number of shipments made during that year since one batch from the refinery tank may have been used for multiple shipments on different orders. Information in *Chart 4* is provided as an indication of the responses received from the different regions. Regions 2 through 5 submitted the largest number of reports. Region 3, which includes Texas, still leads in the submission of reports.

*Chart 5* below represents the volume of aviation fuels, in millions of gallons, refined each **calendar** year from the various Regions and sold to Department of Defense customers. As more locations converted from JP4 to JP8, the total volume of JP4 delivered decreased as the total volume of JP8 delivered increased. Although outside the scope of this report, it is possible to further break down the volumes received by the state in which the refinery is located, by company name, by refinery location or by contract.

### Chart 5

## Yearly Breakdown by Fuel of Volume Received

(Millions of Gallons)

Region										
Year	Fuel	1	2	3	4	5	6	7	8	Total
1995	JP4				61.87			4.89	0.34	67.1
	JP5			55.48				31.74		87.22
	JP8	2.88	126.64	451.51	9.97	239.30		65.12	97.39	992.81
1996	JP4								0.89	0.89
	JP5			308.86		51.36	22.72	71.87	39.65	494.46
	JP8	18.81	191.35	633.67	84.94	426.64	37.28	263.07	176.03	1831.79
1997	JP4								1.64	1.64
	JP5			322.88		210.78	59.19	55.84	58.63	707.32
	JP8	91.36	213.98	799.86	53.28	421.54		261.00	301.48	2142.50
1998	JP4								1.71	1.71
	JP5			310.80		168.26	24.10	54.74	57.90	615.80
	JP8	123.59	215.78	976.11	60.22	434.64	6.68	149.36	262.30	2228.68

Chart 6 provides information on the number of reports received per calendar year for each region. This chart represents a more detailed breakdown of Chart 4. Chart 5 can be used in conjunction with Chart 6 to get an idea of the average parcel size, which can be indicative of which modes of transportation are used. For example, for Region 6 for JP8 in 1996, 7 tenders were reported representing 37.28 million gallons, which means that each tender represented over 5.3 million gallons, or the parcel size of a tanker. Reported for Region 4 in 1997 were 86 tenders representing 53.28 million gallons of JP8, or an average parcel size of 0.619 million gallons or 619,000 USG. This could represent mainly truck shipments mixed in with some pipeline shipments of JP8 during this time frame for Region 4.

### Chart 6

## **Yearly Breakdown by Fuel of Reports Received**

		Region								Total
Year	Fuel	1	2	3	4	5	6	7	8	
1995	JP4				134			1	4	139
	JP5			33				8		41
	JP8	30	83	316	16	154		21	118	738
1996	JP4								6	6
	JP5			111		17	3	21	8	160
	JP8	60	148	433	96	224	7	111	152	1231
1997	JP4								9	9
	JP5			129		74	10	19	20	252
	JP8	97	306	658	86	286		92	170	1695
1998	JP4								10	10
	JP5			125		66	5	19	15	230
	JP8	150	272	872	112	284	1	57	204	1952

### **Product Specifications**

The Military Procurement Specification for JP4 and JP5 is MIL-PRF-5624S, dated 22 November 1996, and MIL-DTL-5624T, dated 18 September 1998, *Turbine Fuel, Aviation, Grades JP-4, JP-5 and JP-5/JP-8 ST*. The specification for JP8 is MIL-T-83133D, dated 29 January 1992, *Turbine Fuels, Aviation, Kerosene Types, NATO F-34 (JP-8), NATO F-35, and JP-8+100*. The JP8 specification was replaced with MIL-DTL-83133E, dated 1 April 1999.

For the purposes of this report, only those specification properties which have measurable and definitive requirements in the specification are summarized, with the exception of cetane index (report only) and naphthalene content (not required for JP5). Also, those specification properties which involve an assigned rating (e.g., water reaction, and copper corrosion) are not summarized. However, data is available for the specification properties not reported by request from the Point-of-Contact (POC) provided in **Section I**. Histograms in **Section II** represent the volumes represented of each test property result for 1998 for all Regions.

Not all tests need to be performed on all batches. For the *Net Heat of Combustion*, contractors have a choice of two or three different units of measurement, depending on the product, for reporting the net heat or energy content. Contractors also have the option of performing the *Doctor Test* in lieu of *Mercaptan Sulfur*. If the *Doctor Test* is negative, the *Mercaptan Sulfur* need not be performed. Some contractors elected to report both the *Doctor Test* and *Mercaptan Sulfur*. If the *Smoke Point* was below 25 mm, the product was still acceptable as long as the *Naphthalenes Content* was below 3.0% and the *Smoke Point* was above the minimum of 19 mm. Therefore, the number of reports represented by the data may be different for individual test parameters. Specification limits are provided on all Histograms and Tables.

## Chart 7

### **Table of JP4 Values for 1998**

<b>Fuel Property</b>	<b>Min</b>	<b>Avg</b>	<b>WtAvg</b>	<b>Max</b>
Saybolt Color	30	30	30	30
Total Acid Number	0.008	0.0107	0.01067	0.014
Aromatics	7.3	8.27	8.15	10.1
Olefins	0	0	0	0
Mercaptan Sulfur	0.0003	0.00068	0.00070	0.0014
Total Sulfur	0.04	0.047	0.046	0.05
Distillation Initial Boiling Point	59	62.8	62.44	68
10% Recovered	83	86.5	86.2	89
20% Recovered	92	94.3	93.9	98
50% Recovered	116	118.9	118.6	123
90% Recovered	232	237.9	237.6	244
Distillation Final Boiling Point	258	261.2	261.2	263
API Gravity	54.4	55.31	55.32	56.1
Freezing Point	-62	-59.3	-59.4	-58
Smoke Point	30	30.4	30.3	32
Hydrogen Content	14.5	14.61	14.61	14.7
Existant Gum	.4	1.08	.99	2.6
Particulates	0.16	0.54	0.53	0.85
Filtration Time	4	5.8	6.0	10
Net Heat of Combustion (MJ)	43.7	43.85	43.86	43.9
Reid Vapor Pressure (kPa)	18.6	19.85	19.76	21.0

JP4 delivered in 1998 was produced in Region 8 only and includes 10 reports representing 1.71 million gallons. The fuel properties of Net Heat of Combustion and Reid Vapor Pressure were added for this 1998 report. Comparison of 1998 averages with 1997 averages available in the previous PQIS report shows the following trends:

No significant changes in	Saybolt Color, Mercaptan Sulfur, Existant Gum
Total Acid Number	Increased from 0.0054 in 1997 to 0.0107 in 1998.
Aromatics	Decrease from 12.31% in 1997 to 8.27% in 1998.
Total Sulfur	Increased from 0.019% in 1997 to 0.047% in 1998
Distillation	Decrease in all Percents Recovered. 10% Recovered decreased from 96.03°C in 1997 to 86.5°C in 1998. Fuel is getting lighter.
API Gravity	Slight increase from 54.55 in 1997 to 55.31 in 1998.
Freezing Point	Slight increase from -61.5°C on 1997 to -59.3°C in 1998.
Smoke Point	Increase from 26.08 in 1997 to 30.4 in 1998.
Hydrogen Content	Slight increase from 14.3 in 1997 to 14.6 in 1998.
Particulates	Slight increase from 0.35 in 1997 to 0.54 in 1998.
Filtration Time	Slight increase from 4.6 in 1997 to 5.8 in 1998.

Chart 8

**Table of AN8 Values for 1996 - 1998**

<b>Fuel Property</b>	<b>Min</b>	<b>Avg</b>	<b>WtAvg</b>	<b>Max</b>
Saybolt Color	17	22.4	21.0	27
Total Acid Number	0.001	0.0063	0.0060	.013
Aromatics	13.1	14.47	14.54	16.3
Olefins	0.2	0.95	0.78	2.2
Mercaptan Sulfur	.0001	0.00082	0.00098	0.0019
Total Sulfur	0.01	0.042	0.062	0.15
Distillation Initial Boiling Point	143.0	148.36	147.47	152.1
10% Recovered	163.0	165.00	164.74	168.0
20% Recovered	167.0	171.42	171.00	175.0
50% Recovered	177.0	191.03	189.57	198.5
90% Recovered	195.0	232.18	227.89	252.5
Distillation Final Boiling Point	209	255.83	250.19	268.5
API Gravity	41.1	44.43	45.41	49.7
Freezing Point	-62.0	-59.48	-59.2	-58.3
Smoke Point	19.6	23.08	23.50	27.6
Hydrogen Content	13.6	13.83	13.88	14.11
Existant Gum	0.8	1.27	1.55	3.0
Particulates	0.05	0.376	0.396	0.53
Naphthalenes	1.6	1.76	1.70	1.9
Net Heat of Combustion (MJ)	43.1	43.23	43.26	43.4
Cetane Index	35.0	38.2	39.2	42.7
Filtration Time	4	6.7	6.7	10
Viscosity	3.1	3.71	3.60	4.3

All temperatures are in degrees Centigrade. AN8 delivered in 1998 was produced in Regions 7 and 8 and includes 10 reports representing 15.7 million gallons of product. The fuel properties of Naphthalenes, Net Heat of Combustion and Cetane Index were added for this 1998 report. Since only one delivery of AN8 was made in 1998, data for 1996 through 1998 are included in the summary above.

### **Section III - Histogram Charts**

Created in Harvard Chart XL, each histogram shows, for each product and fuel characteristic, the percent by volume of product refined for delivery to the US Government for 1998 worldwide. The grade of fuel and specification value is indicated in the text within the chart, along with the mean and standard deviation values. Harvard Chart XL automatically calculated the mean and standard deviation for each Histogram. The percentages above the bar represents the percent of total volume of data falling within the data ranges indicated on the x-axis. Heavy dashed lines in the graph represent specification values. To insure all data is included, the first and last bars, where appropriate, have an allowance for data outside of the ranges upon which the histograms are based. A "<[low value]" indicates all occurrences of volumes less than lower range [low value] and a "[high value]+" indicates all occurrences of volumes greater than the upper range [high value].

The data indicates the overall distribution of test results on a worldwide basis for 1998. No attempt was made to separate results by the test method used where more than one method was possible, although this also can be done if requested.

Values are grouped into data ranges indicated in the x-axis. The range includes data at the lower limit and up to, but not including, the upper limit. Because of this, values in the next data grouping above the specification limit indicated by dashed line may include data which match the upper limit of the specification. Consult the respective table in the Appendix Section to determine the maximum value for that property to determine if any volume purchased exceeded the specification limit.

Because the mean indicates the value at which 50% of the data occurs and the bars on the Histograms display volume percentages, the mean may not always occur where visual inspection of the Histogram indicates. The differences in two values are similar to the differences between the average and the volumetrically-weighted average.



Chart 9

# Distribution of API Gravity by Volume Received for 1998 (Millions of Gallons)

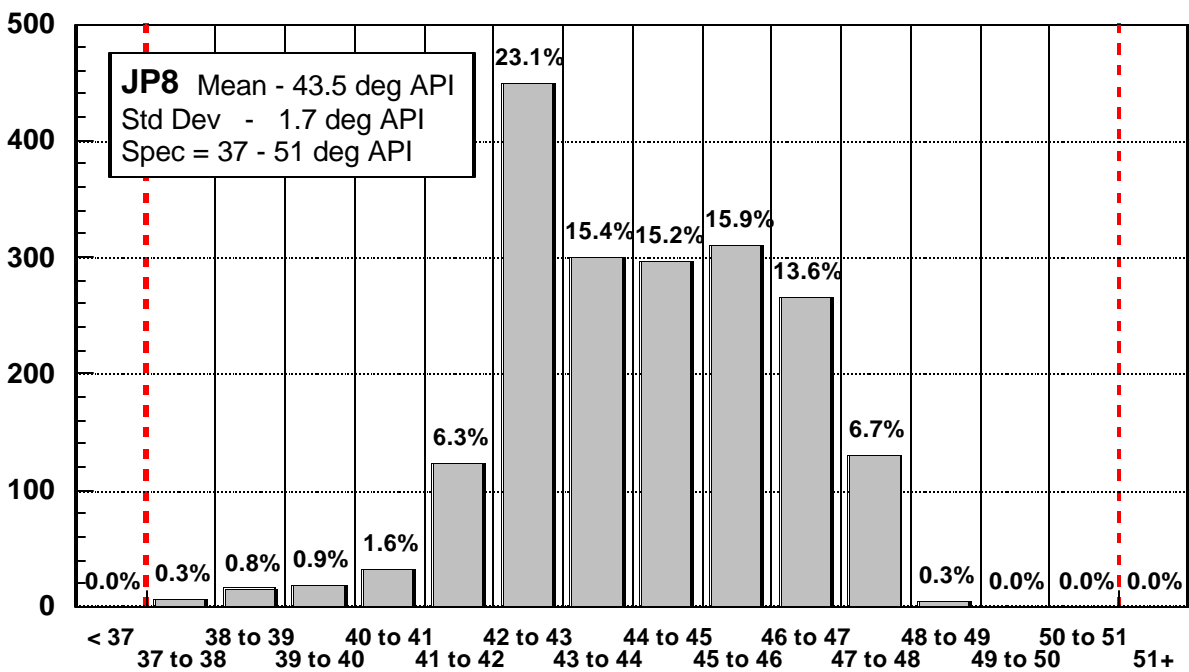
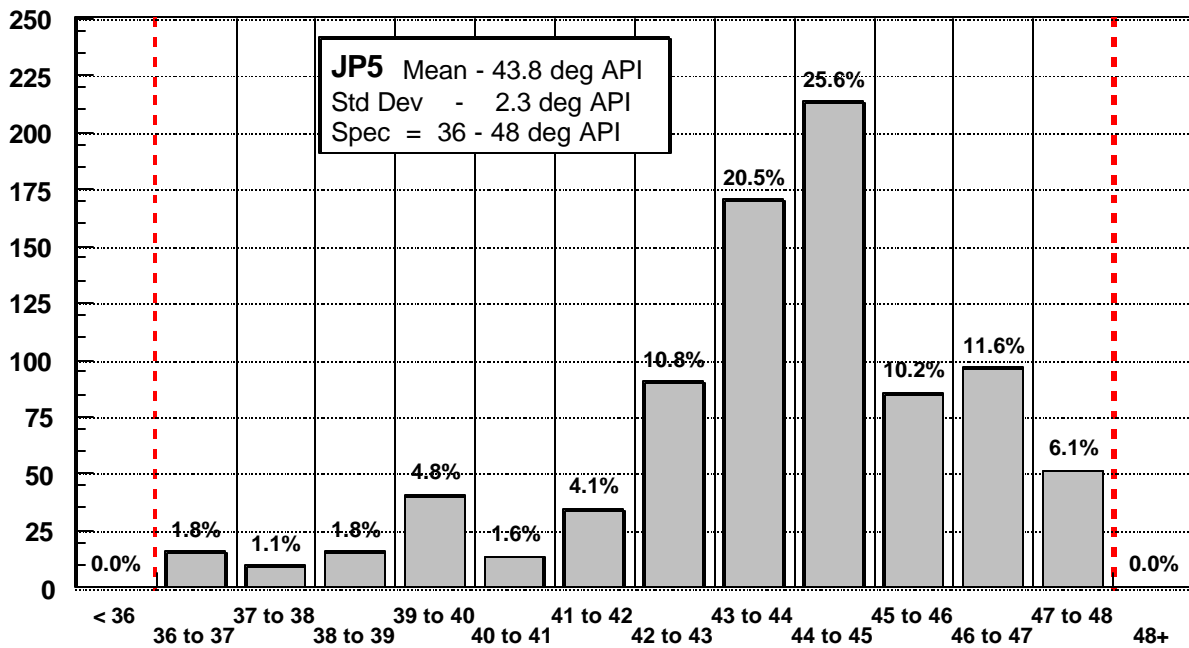


Chart 10

# Distribution of Aromatics by Volume Received for 1998

(Millions of Gallons)

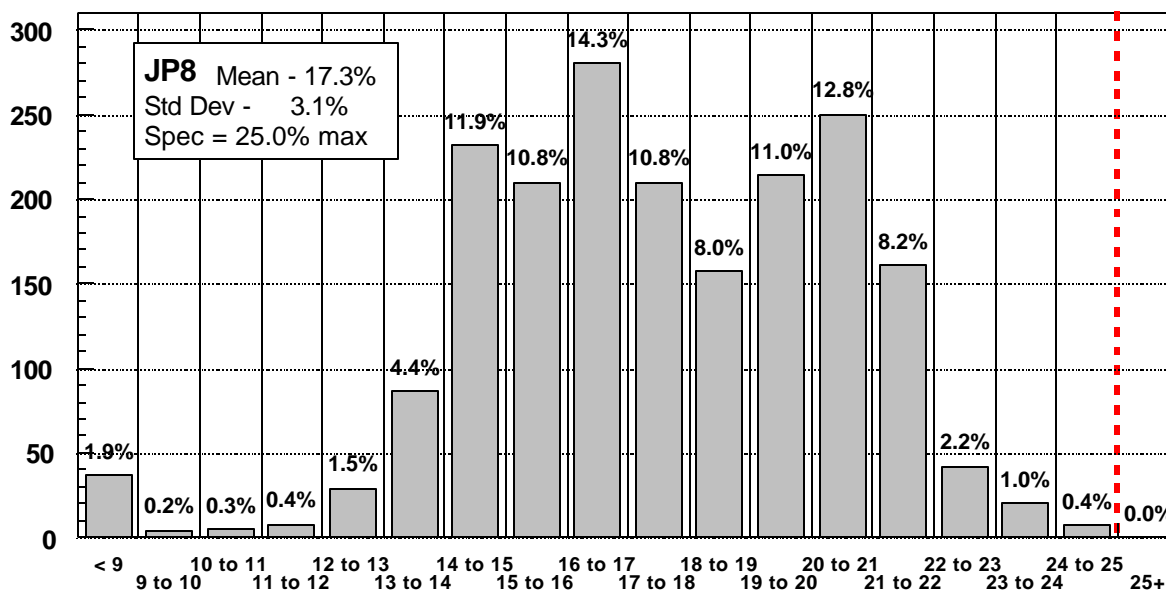
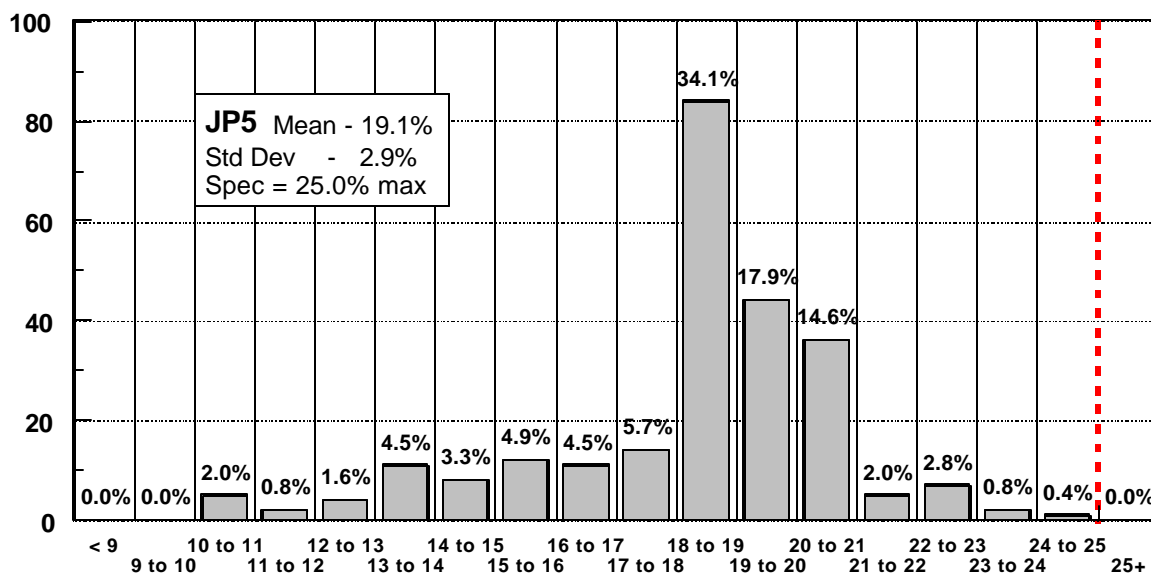


Chart 11

# Distribution of Olefins by Volume Received for 1998

(Millions of Gallons)

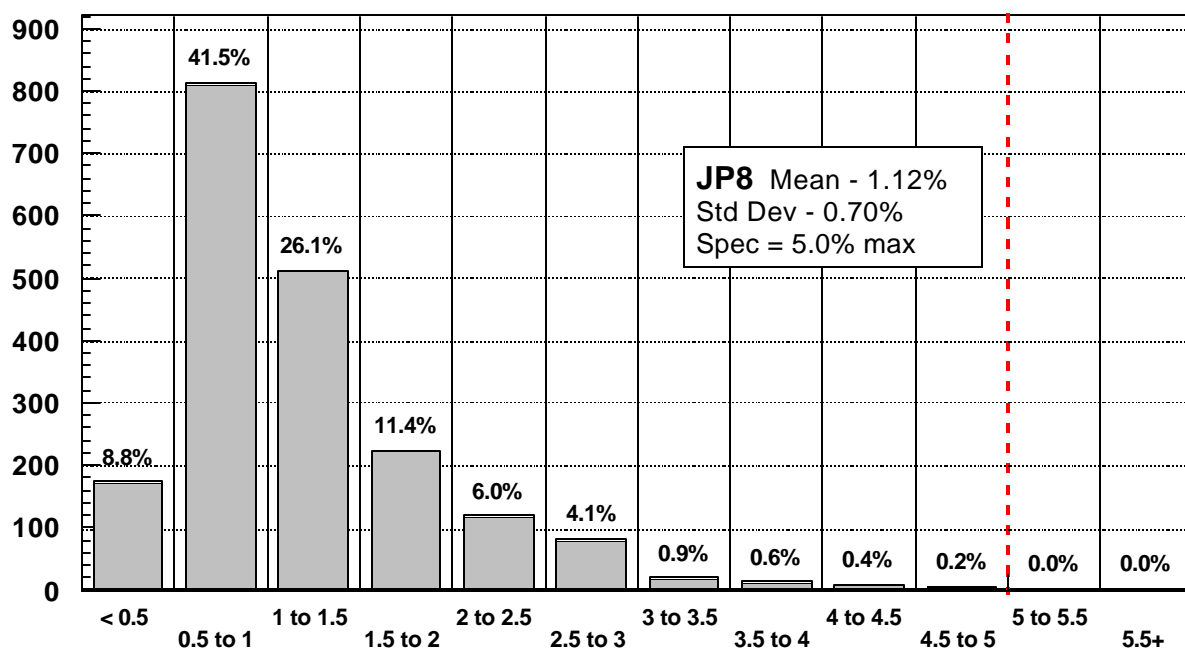
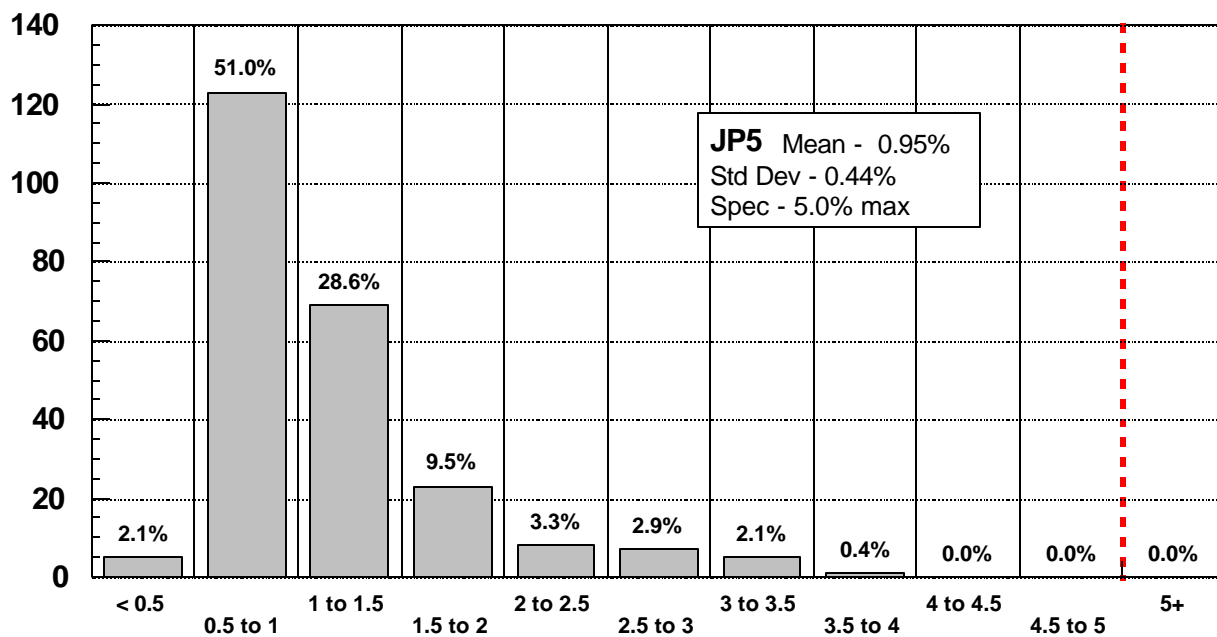


Chart 12

Distribution of Total Sulfur by Volume Received for 1998  
(Millions of Gallons)

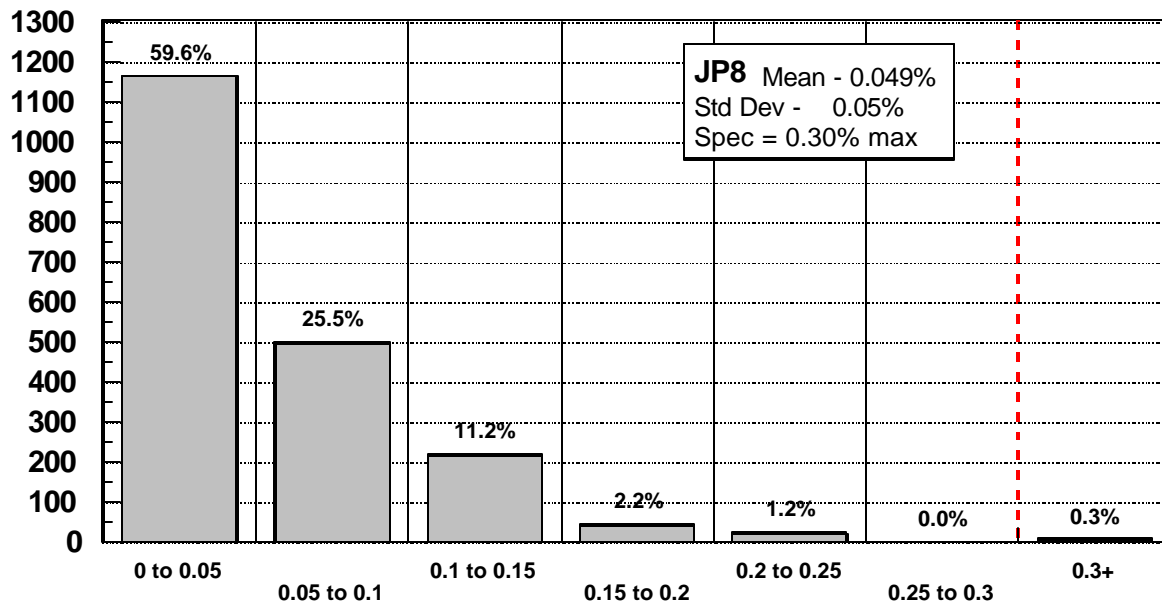
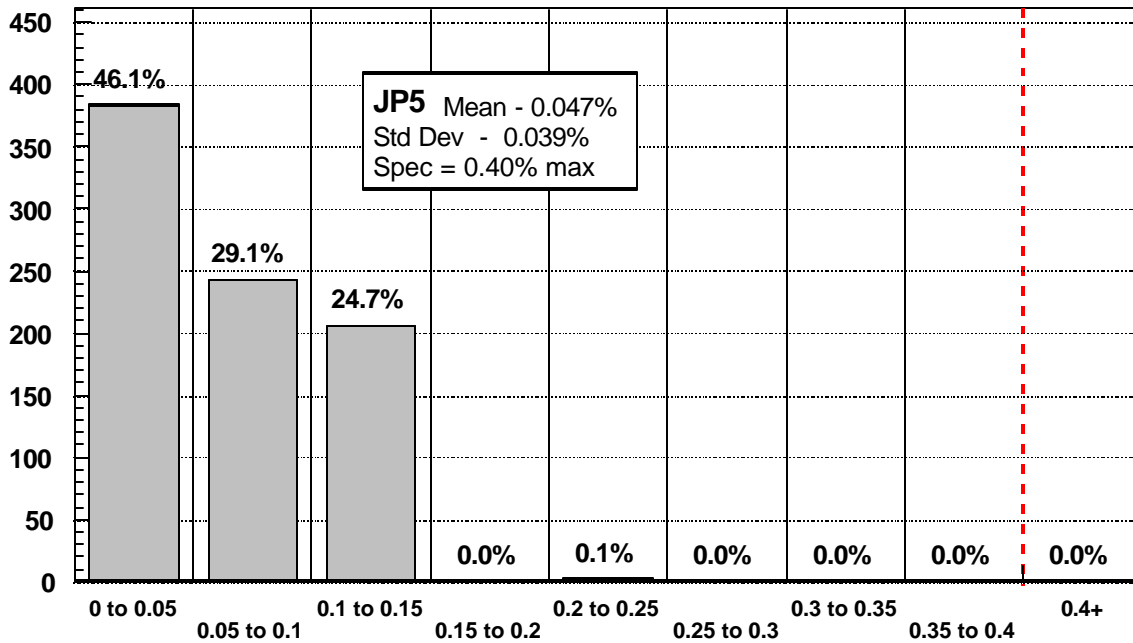


Chart 13

Distribution of Mercaptan Sulfur by Volume Received for 1998  
(Millions of Gallons)

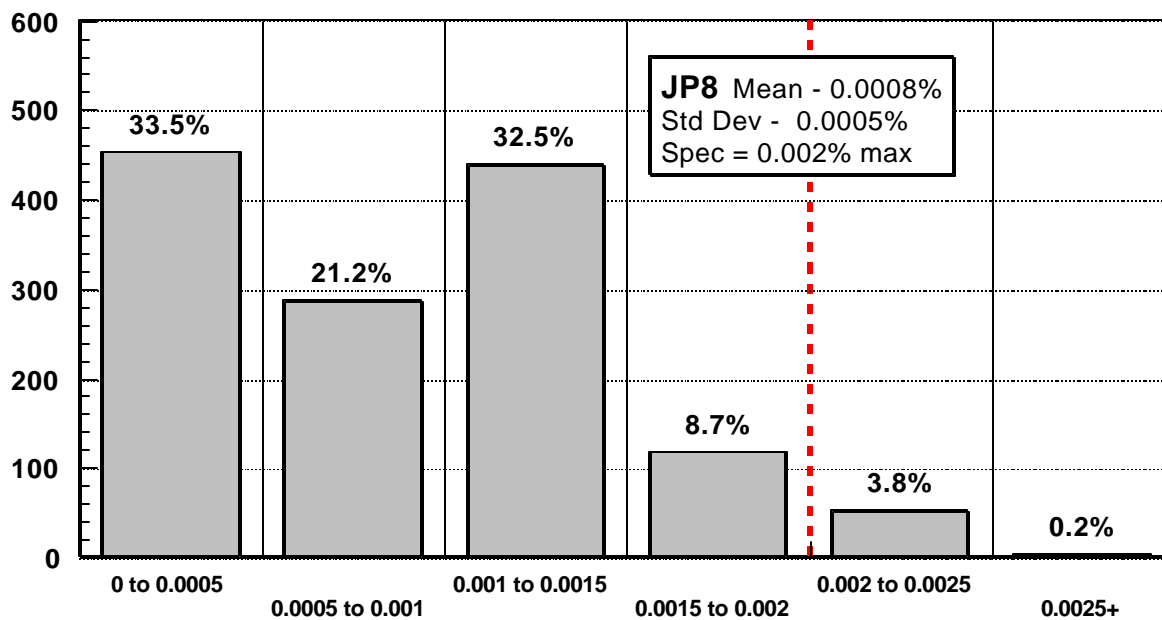
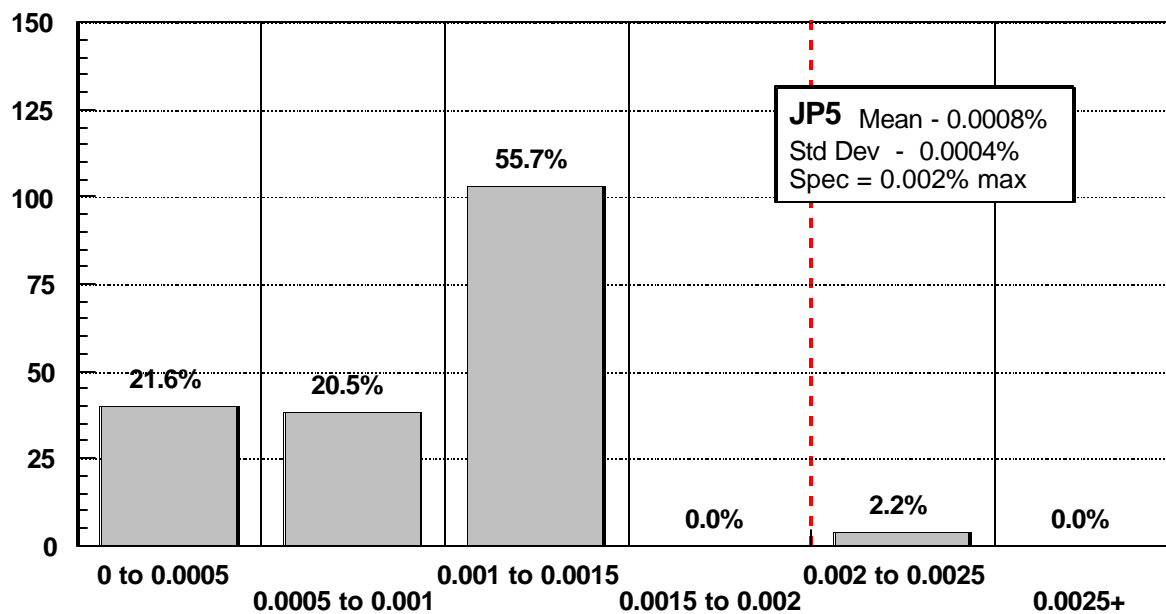


Chart 14

## Distribution of Particulate Contamination by Volume Received for 1998

(Millions of Gallons)

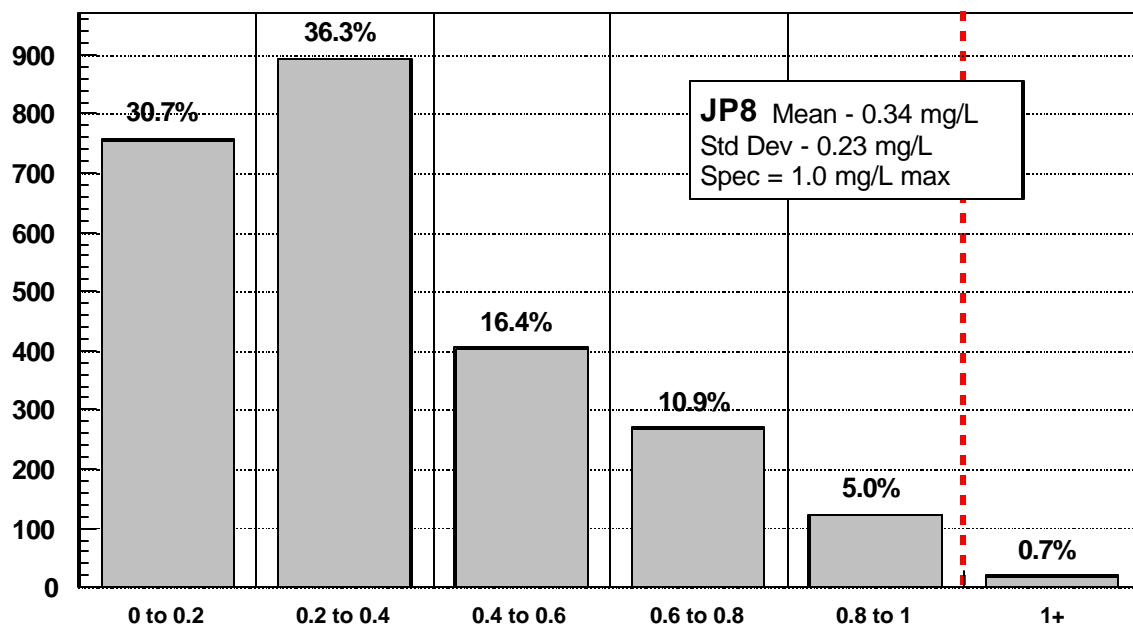
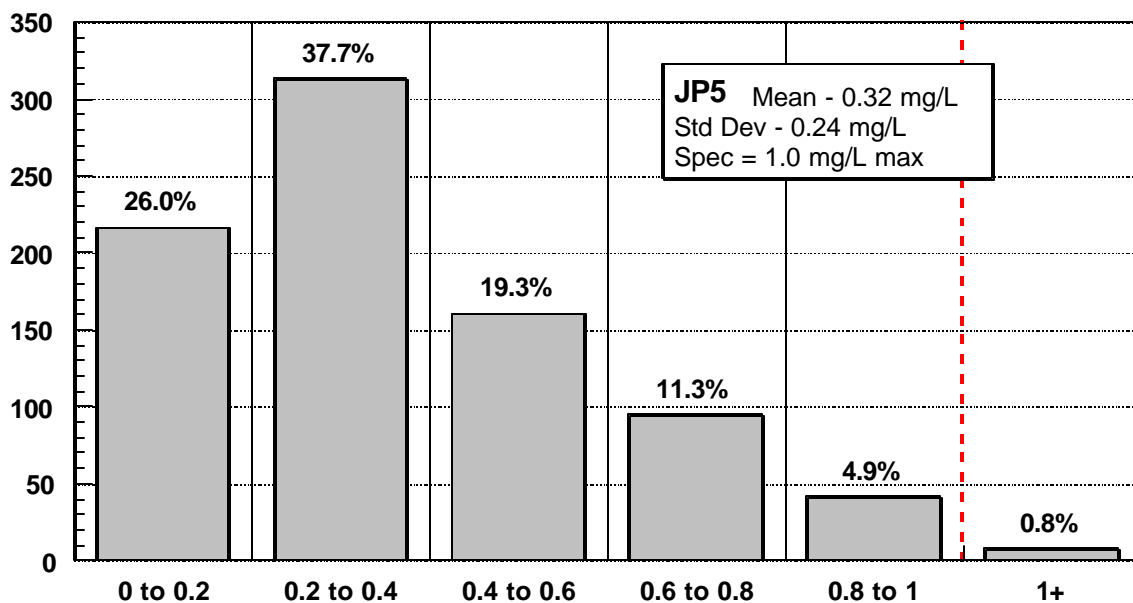




Chart 15

# Distribution of Filtration Time by Volume Received for 1998

(Millions of Gallons)

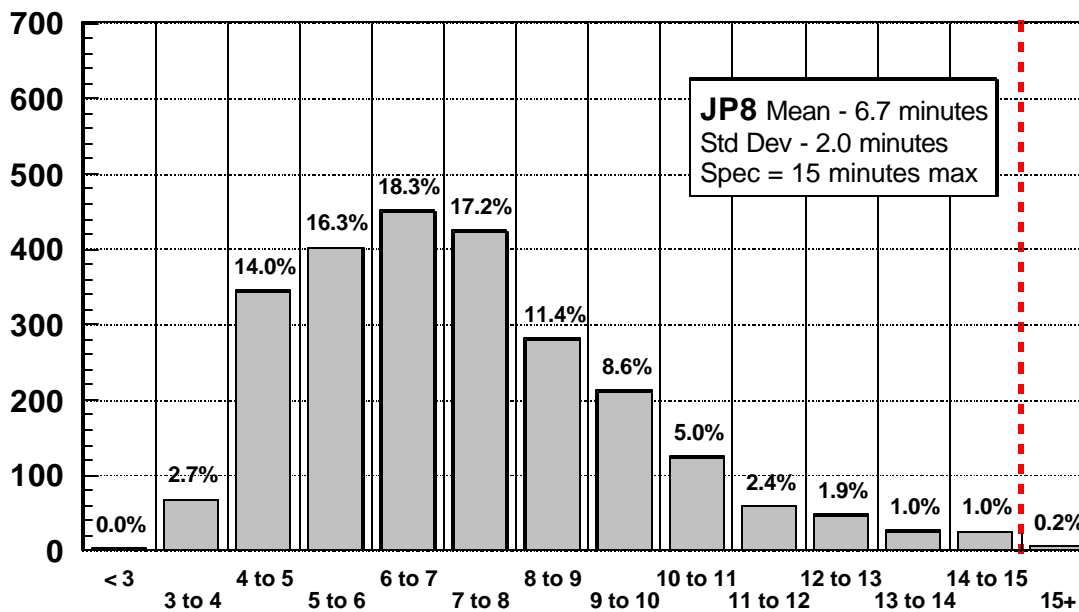
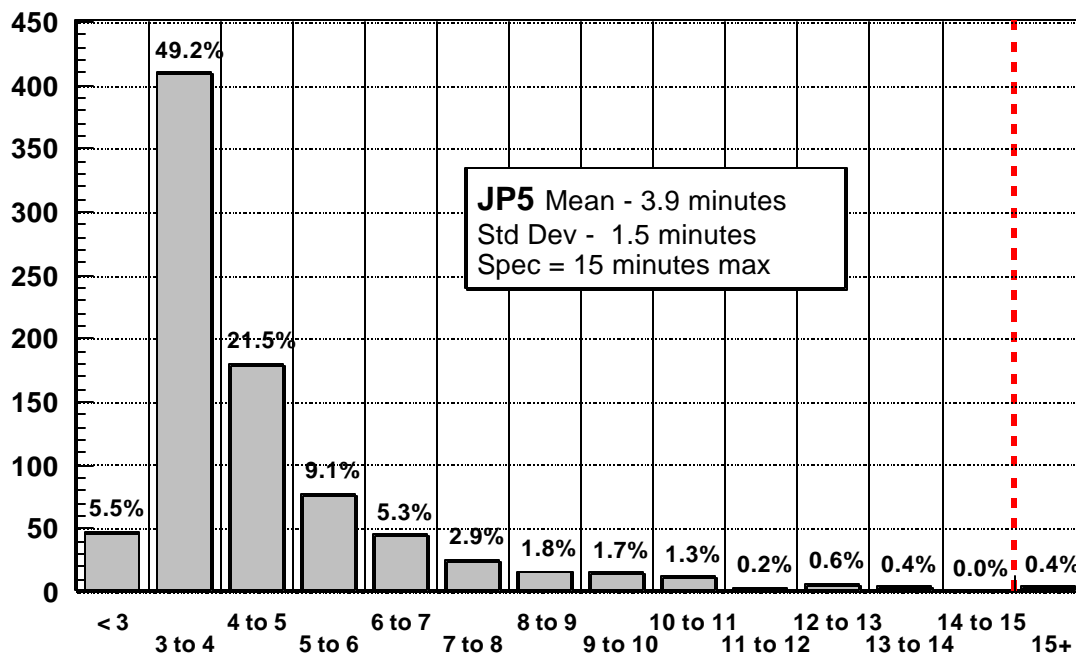


Chart 16

# Distribution of Total Acid Number by Volume Received for 1998

(Millions of Gallons)

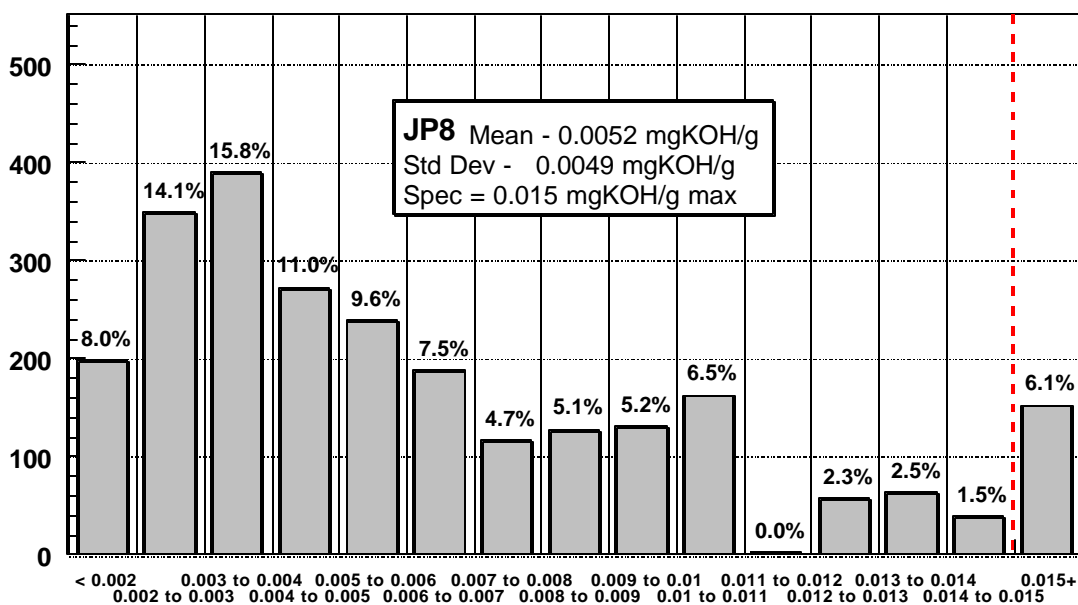
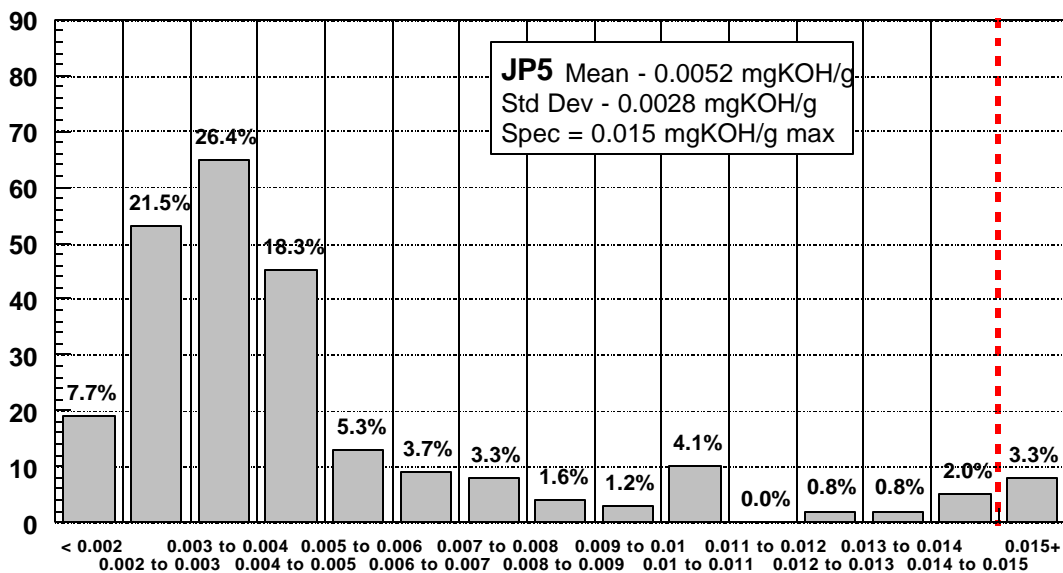


Chart 17

# Distribution of Smoke Point by Volume Received for 1998

(Millions of Gallons)

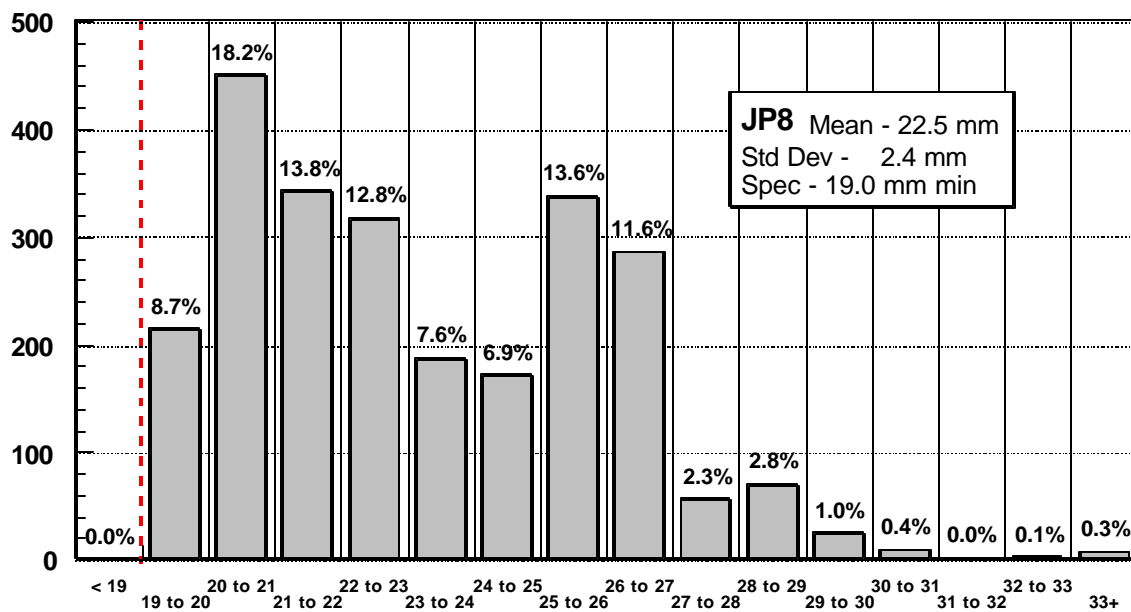
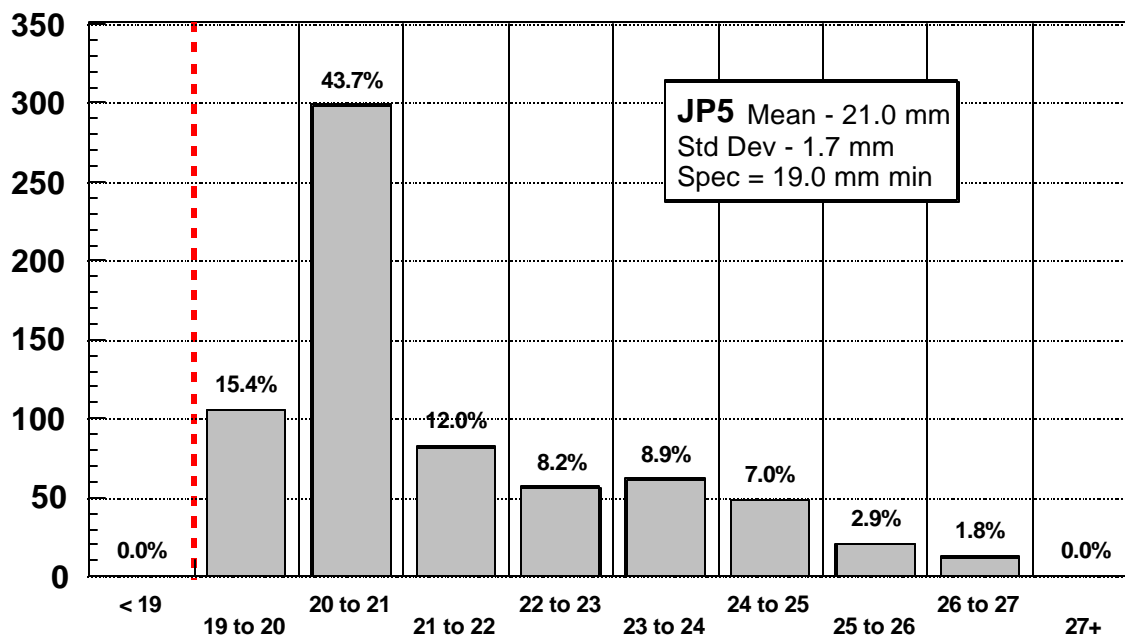


Chart 18

Distribution of Naphthalenes by Volume Received for 1998  
(Millions of Gallons)

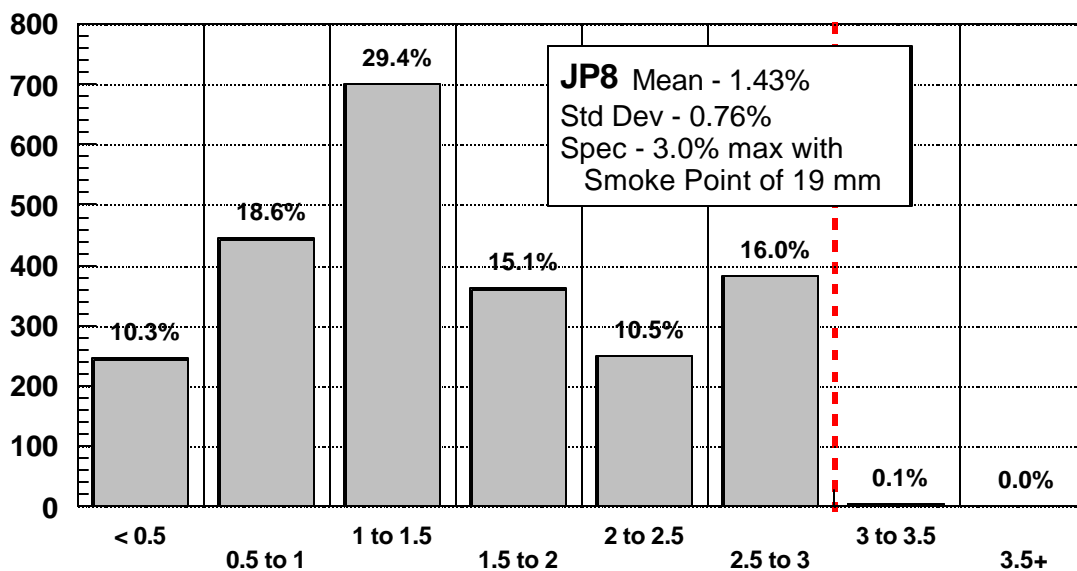
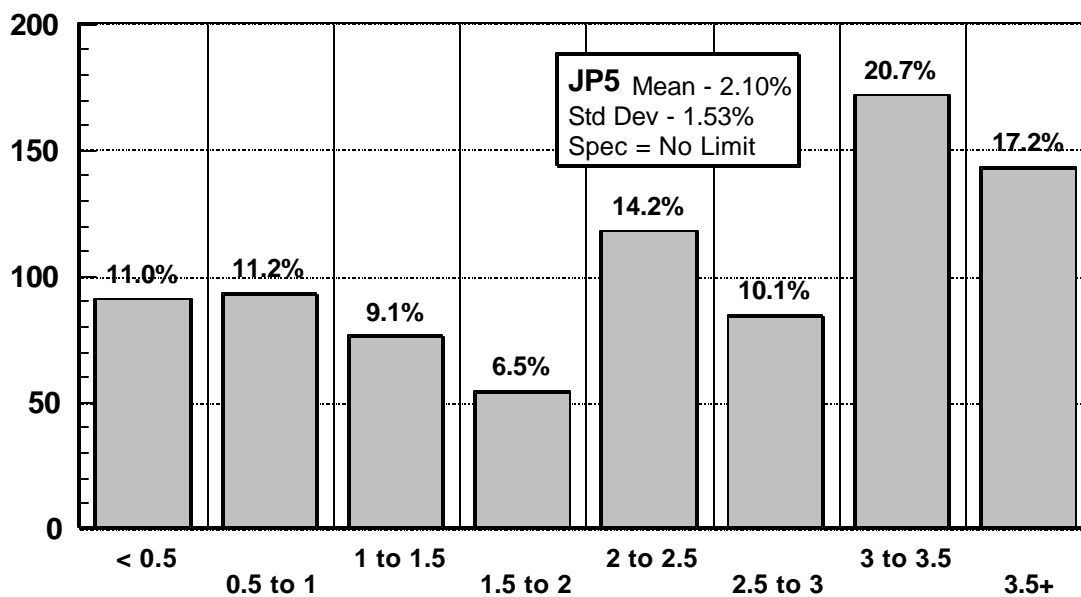


Chart 19

# Distribution of Hydrogen Content by Volume Received for 1998

(Millions of Gallons)

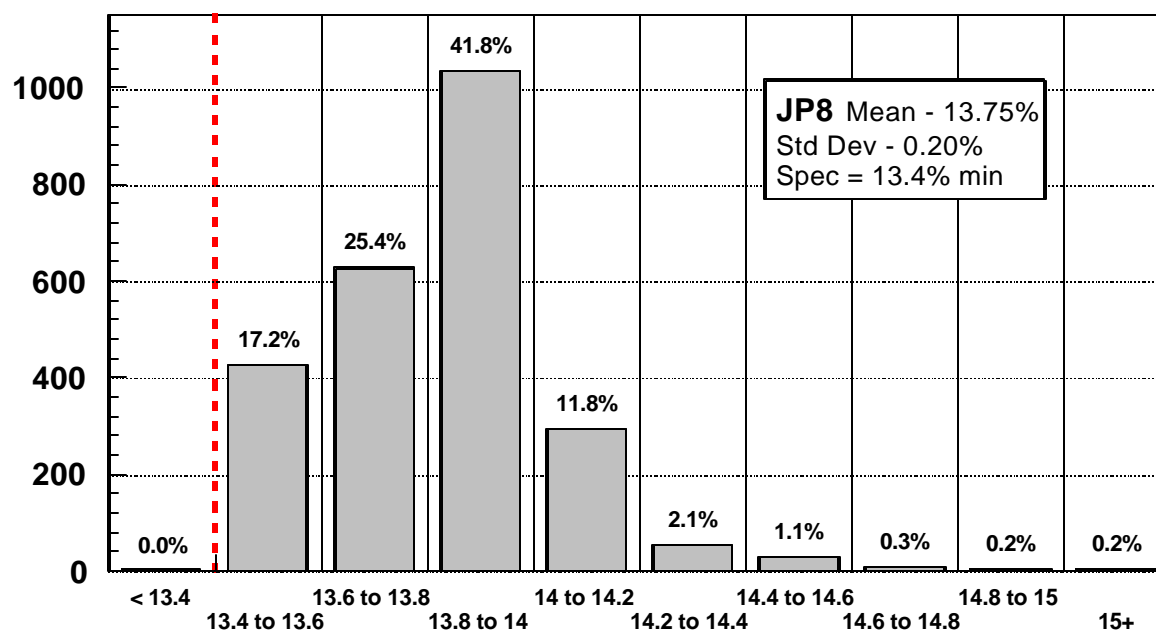
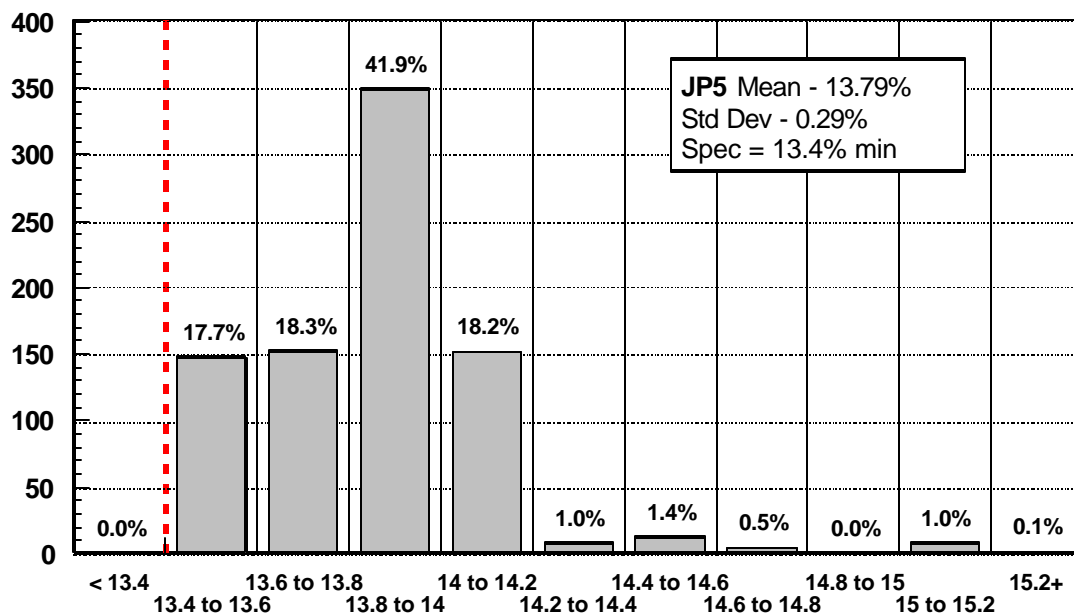


Chart 20

# Distribution of Flash Point by Volume Received for 1998 (Millions of Gallons)

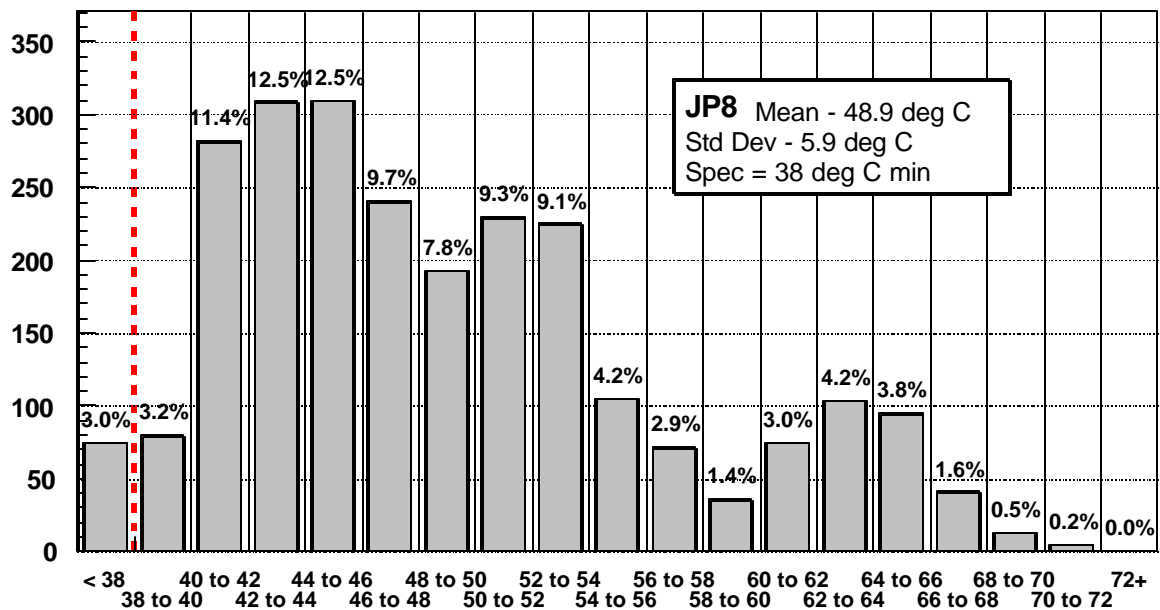
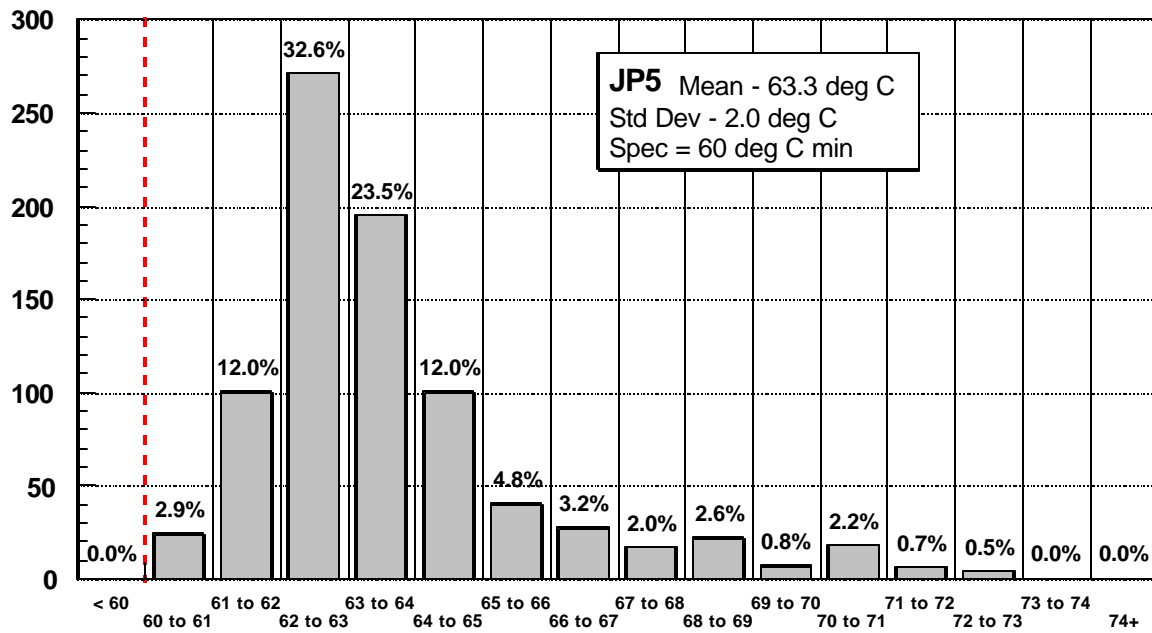
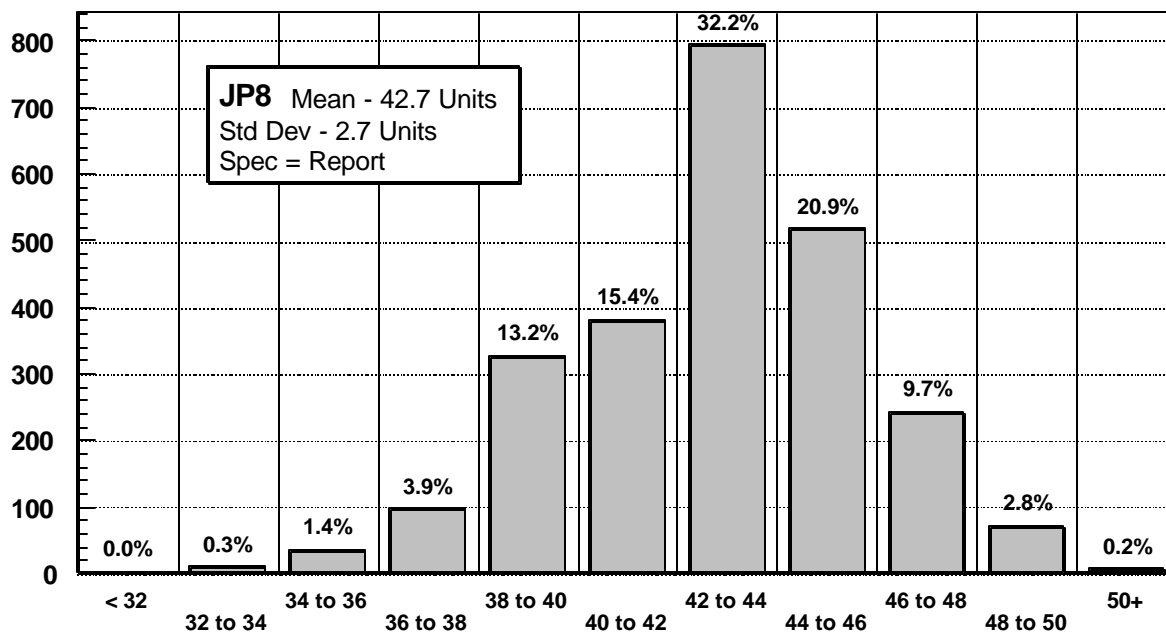
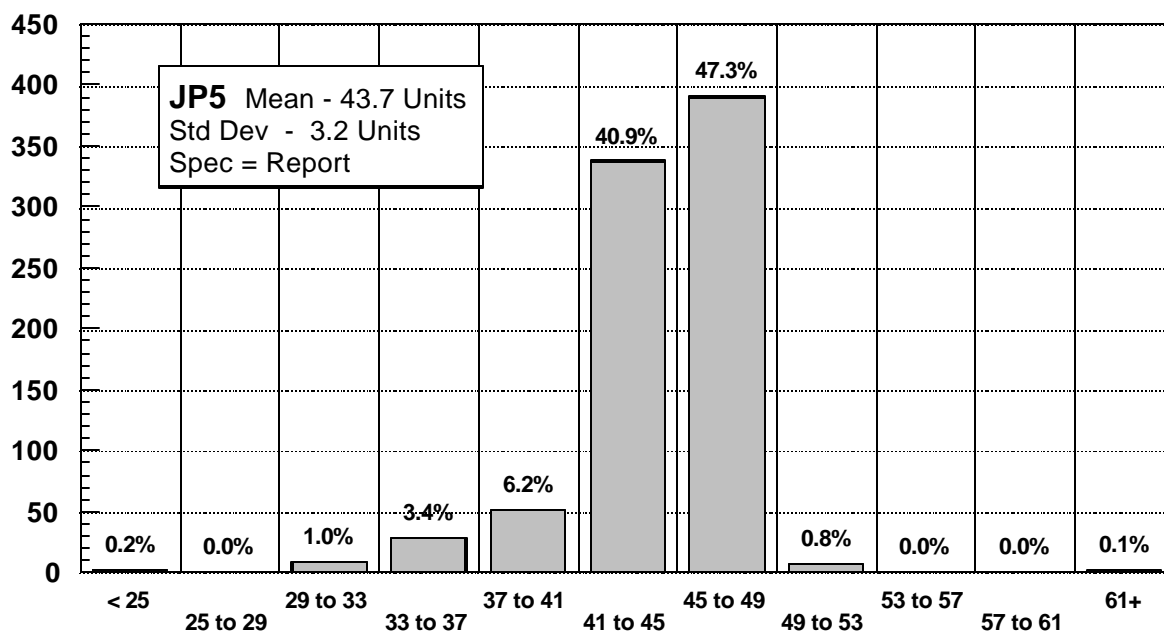




Chart 21

# Distribution of Cetane Index by Volume Received for 1998

(Millions of Gallons)



## **Section IV - Conclusions**

Comparing Histograms for 1997 to the Histograms for 1998, no significant changes in either the mean value or the shape of the curve for both JP5 and JP8 was seen for:

*Olefins, Total Sulfur, Mercaptan Sulfur, Particulate Contamination, Filtration Time, Total Acid Number, Smoke Point, Naphthalenes, Hydrogen Content, Flash Point and Cetane Number.*

For API Gravity, JP5 showed a very slight shift (1° API) to a higher *API Gravity* but no change in shape. For JP8, the mean stayed the same, but the curve became narrower with about 97% of fuel volume purchased between the range of 41° and 48° API. Although *Aromatics* showed no change in mean value or shape, about 1.9% of the volume occurred at a value of 9% Aromatics or below.

Histograms show that greater than 99% of the volume of fuel received in 1998 met all graphed specification properties, except for the properties of Mercaptan Sulfur and the Total Acid Number. See the Tables for Mercaptan Sulfur and Total Acid Number for a further discussion of product which exceeded specification limits.

In the Appendix are Tables which provide the minimum, average, weighted average and maximum values for a product property by fuel grade, year, and region. These Tables are used as a supplement to the histograms in Section II. This report provided three means for reporting a mid-range test result for each property for each Region and calendar year: the mean, the average and the volumetrically-weighted average. Each calculation is based on a different focus, thus producing different results. Analysis of individual properties is provided below.

## **Appendix - Tables of Property Values**

The following tables are designed to show the minimum, average, volumetrically weighted average and maximum values for each fuel property of the specified grade of fuel. The values are broken down by calendar year and by region. Also supplied for each year and region combination is the volume, in millions of gallons, represented by the data as well as the number of reports that contained data in the field. These charts are designed to be “stand alone”, with all the information contained within each chart to allow it to be separated from the main body of the report and still be useable.

Using these charts, it is possible to compare averages from different regions. For example, if a researcher desires a comparison in average API Gravity of JP8, the researcher will go to Table 2 - “Values of JP8 for API Gravity by Region” (on the following page) and observe the values for Region 1 (East Coast) and compare those with Region 2 (East Central). The researcher would find that the fuel supplied in Region 1 tends to be lower in API Gravity than the fuel supplied in Region 2. The researcher would then evaluate the significance, if any, of this observation.

For each product and test property, specific comments are made at the bottom of each Table pertaining to observable trends for both the Histograms and the Tables. Comparison of Histograms are made to 1997 information for either changes in the shape of the data distribution and/or changes in volume percentages occurring within a specified range of test result values.

Table 1

**Values of JP5 for API Gravity by Region**

(Volume in Millions of Gallons)

(Spec = 36 - 48° API)

Year	Region	Fuel	Volume	Min	Avg	WtAvg	Max	Count
1995	3	JP5	55.5	37.1	42.76	42.78	44.2	33
1995	7	JP5	31.7	40.8	43.44	43.72	46.5	8
1996	3	JP5	308.9	37.2	43.60	43.69	47.8	111
1996	5	JP5	51.4	39.3	40.34	40.80	41.8	17
1996	6	JP5	22.7	44.1	45.13	44.98	45.7	3
1996	7	JP5	71.9	41.2	43.82	43.96	46.8	21
1996	8	JP5	39.6	44.4	45.11	45.12	46.0	8
1997	3	JP5	322.9	42.1	43.94	44.04	44.8	129
1997	5	JP5	210.8	36.6	39.86	40.56	43.1	74
1997	6	JP5	59.2	40.8	43.05	42.92	44.2	10
1997	7	JP5	55.8	41.1	43.44	43.52	45.9	19
1997	8	JP5	58.6	40.7	43.58	43.61	45.9	20
1998	3	JP5	310.8	42.3	44.14	44.21	45.1	125
1998	5	JP5	168.3	36.4	38.82	39.17	41.9	66
1998	6	JP5	24.1	40.6	40.76	40.74	41.1	5
1998	7	JP5	54.7	40.6	44.38	44.33	46.4	19
1998	8	JP5	57.9	40.4	44.12	45.05	46.2	15

All fuel procured met specifications for 1998.

Histogram: The mean value increased to 43.8° API (1998) from 42.6° API (1997). Histogram shows a relative increase in volume procured in the 45-48° API range. Volume procured in the 43-48° API range rose from 57.4% in 1997 to 74.0% in 1998.

Table: Region 5 (West Coast) produced the heaviest product (lower API gravity average) and Region 7 (European) produced the lightest product (higher API gravity average). Higher density fuel increases aircraft flight range for volume-limited aircraft. For Region 3 (Gulf Coast), the average API rose from 1995 to 1998.

Table 2

**Values of JP8 for API Gravity by Region**

(Volume in Millions of Gallons)

(Spec = 37.0 - 51.0° API)

Year	Region	Fuel	Volume	Min	Avg	WtAvg	Max	Count
1995	1	JP8	2.9	40.9	42.79	42.91	44.7	30
1995	2	JP8	126.6	42.2	44.23	44.29	45.0	83
1995	3	JP8	451.5	41.0	44.29	44.38	48.7	316
1995	4	JP8	10.0	42.8	44.77	44.72	46.8	16
1995	5	JP8	239.3	39.7	41.75	42.00	44.1	154
1995	7	JP8	65.1	41.8	45.35	45.32	48.0	21
1995	8	JP8	97.4	41.9	43.03	43.11	46.1	118
1996	1	JP8	18.8	41.2	42.87	44.11	45.3	60
1996	2	JP8	191.4	41.4	44.35	44.22	46.0	148
1996	3	JP8	633.7	40.5	44.34	44.02	48.2	433
1996	4	JP8	84.9	42.4	45.31	45.20	47.2	96
1996	5	JP8	426.6	39.1	41.42	41.94	46.0	224
1996	6	JP8	37.3	45.9	46.19	46.18	46.3	7
1996	7	JP8	263.1	40.8	45.10	45.40	48.0	111
1996	8	JP8	176.0	42.0	43.91	45.80	50.1	152
1997	1	JP8	91.4	41.0	44.12	44.83	46.4	97
1997	2	JP8	214.0	39.0	44.32	44.15	47.3	306
1997	3	JP8	799.9	40.3	44.67	44.27	49.4	658
1997	4	JP8	53.3	42.2	45.68	45.92	46.9	86
1997	5	JP8	421.5	38.5	41.36	41.63	44.9	286
1997	7	JP8	261.0	39.5	45.67	45.90	48.0	92
1997	8	JP8	301.5	41.7	44.07	45.44	48.6	170
1998	1	JP8	123.6	41.1	43.70	44.71	46.1	150
1998	2	JP8	215.8	38.0	44.13	43.62	48.1	272
1998	3	JP8	976.1	40.8	44.63	43.93	47.5	872
1998	4	JP8	60.2	43.5	45.26	45.54	46.6	112
1998	5	JP8	434.6	37.2	41.82	41.57	44.1	284
1998	6	JP8	6.7	46.0	46.00	46.00	46.0	1
1998	7	JP8	149.4	40.5	45.54	45.64	47.5	57
1998	8	JP8	262.3	41.7	44.34	45.54	48.4	204

All fuel procured met specifications for 1998.

Histogram: While the mean remained constant from 1997 (43.7° API), the maximum has shifted to the 42-43° API range in 1998 from the 44-45° API range from 1997. In 1998, 83.2% of the fuel was purchased in the 42-47° API range compared with 76.4% from 1997.

Table: Region 5 (West Coast) produced the heaviest product. Regions 4 (West Central) and 6 (Middle East) produced the lightest product. For Region 2 (East Central), while the average is constant, the minimum APIs are decreasing by about 1° API per year with the maximums increasing.

Table 3

**Values of JP5 for Aromatics by Region**

(Volume in Millions of Gallons)

(Spec = 25.0% max)

Year	Region	Fuel	Volume	Min	Avg	WtAvg	Max	Count
1995	3	JP5	55.5	11.5	16.79	17.34	20.2	33
1995	7	JP5	31.7	19.0	20.06	20.11	21.0	8
1996	3	JP5	308.9	12.8	18.51	18.60	23.6	111
1996	5	JP5	51.4	19.0	20.47	20.56	22.9	17
1996	6	JP5	22.7	16.2	19.33	20.38	21.8	3
1996	7	JP5	71.9	15.6	18.64	18.54	20.7	21
1996	8	JP5	39.6	15.6	16.43	16.41	18.4	8
1997	3	JP5	322.9	11.8	18.41	18.74	20.6	129
1997	5	JP5	210.8	13.0	19.80	20.08	22.6	74
1997	6	JP5	59.2	18.0	19.46	19.40	20.7	10
1997	7	JP5	55.8	18.6	19.98	20.07	22.6	19
1997	8	JP5	58.6	14.0	16.85	16.80	19.6	20
1998	3	JP5	310.8	11.5	18.39	18.57	20.8	125
1998	5	JP5	168.3	10.0	18.04	18.08	24.1	66
1998	6	JP5	24.1	20.0	21.66	21.59	22.8	5
1998	7	JP5	54.7	15.3	18.75	18.59	20.4	19
1998	8	JP5	57.9	14.0	16.99	16.35	20.3	15

All fuel procured met specifications for 1998.

Histograms: The mean increased from 18.9% in 1997 to 19.1% in 1998. The percentage of product procured in the lower aromatic range has almost doubled from 1997 to 1998. Product procured in the 10-17% aromatics range rose from 11.3% in 1997 to 21.6% in 1998.

Tables: For JP5, Region 8 (Pacific) has the lowest average, minimum and maximum aromatics and Region 6 (Middle East) reported the highest average aromatics. Region 6 shows an increase in average aromatic content from 19.33% in 1996 to 21.66% in 1998.



Table 4

**Values of JP8 for Aromatics by Region**

(Volume in Millions of Gallons)

(Spec = 25.0% max)

Year	Region	Fuel	Volume	Min	Avg	WtAvg	Max	Count
1995	1	JP8	2.9	17.0	19.25	19.12	20.7	30
1995	2	JP8	126.6	11.0	15.27	15.31	22.6	83
1995	3	JP8	451.5	7.1	17.57	17.81	24.8	316
1995	4	JP8	10.0	13.7	17.29	16.95	21.2	16
1995	5	JP8	239.3	10.9	20.79	18.49	25.0	154
1995	7	JP8	65.1	9.7	16.75	16.74	21.8	21
1995	8	JP8	97.4	10.1	18.30	17.94	22.0	118
1996	1	JP8	18.8	17.5	19.56	19.87	23.7	60
1996	2	JP8	191.4	11.1	14.64	14.97	21.5	148
1996	3	JP8	633.7	9.1	17.66	18.56	24.9	433
1996	4	JP8	84.9	13.0	17.65	17.89	22.9	96
1996	5	JP8	426.6	7.8	18.61	16.66	24.6	224
1996	6	JP8	37.3	15.8	16.01	16.00	16.3	7
1996	7	JP8	263.1	12.2	18.25	17.17	23.0	111
1996	8	JP8	176.0	13.0	18.41	17.15	21.1	152
1997	1	JP8	91.4	12.9	17.70	16.43	21.8	97
1997	2	JP8	214.0	6.1	14.33	14.43	21.0	306
1997	3	JP8	799.9	6.0	17.60	18.90	24.6	658
1997	4	JP8	53.3	13.1	16.52	15.92	22.0	86
1997	5	JP8	421.5	10.7	19.83	17.75	23.7	286
1997	7	JP8	261.0	13.5	17.17	16.60	23.0	92
1997	8	JP8	301.5	10.8	18.58	17.81	20.9	170
1998	1	JP8	123.6	14.3	18.05	16.59	21.8	150
1998	2	JP8	215.8	5.2	13.94	14.75	22.6	272
1998	3	JP8	976.1	10.4	17.60	18.75	24.8	872
1998	4	JP8	60.2	12.2	16.31	15.80	21.5	112
1998	5	JP8	434.6	9.4	19.63	17.71	22.9	284
1998	6	JP8	6.7	16.2	16.20	16.20	16.2	1
1998	7	JP8	149.4	12.3	16.85	16.70	20.3	57
1998	8	JP8	262.3	6.8	18.25	17.57	24.9	204

All fuel procured met specifications for 1998.

Histogram: Mean values and standard deviations for 1997 and 1998 are consistent. However, JP8 has a lower mean (17.3%) than JP5 (19.1%).

Table: Average aromatics for Region 7 (Europe) has been dropping from 1996 to 1998. Region 2 (East Central) produced fuel with the lowest average content and this average has been steadily decreasing from 1995 – 1998. Region 5 (West Coast) produces fuel with the highest average aromatic content.

Table 5

**Values of JP5 for Olefins by Region**

(Volume in Millions of Gallons)

(Spec = 5.0% max, "S" Revision, No Requirement)

Year	Region	Fuel	Volume	Min	Avg	WtAvg	Max	Count
1995	3	JP5	55.5	0.5	0.97	0.99	2.1	33
1995	7	JP5	31.7	0.5	0.79	0.78	1.2	8
1996	3	JP5	308.9	0.1	0.91	0.89	2.0	111
1996	5	JP5	51.4	0.8	1.19	1.11	2.0	17
1996	6	JP5	22.7	0.3	0.37	0.39	0.5	3
1996	7	JP5	71.9	0.2	0.97	0.96	2.0	21
1996	8	JP5	39.6	0.6	0.79	0.78	1.0	8
1997	3	JP5	322.9	0.4	0.87	0.82	2.7	129
1997	5	JP5	210.8	0.6	1.72	1.66	4.8	74
1997	6	JP5	59.2	0.4	0.65	0.70	1.2	10
1997	7	JP5	55.8	0.5	1.17	1.13	2.2	19
1997	8	JP5	56.6	0.4	0.88	1.06	1.4	18
1998	3	JP5	303.2	0.6	0.89	0.88	2.6	120
1998	5	JP5	148.6	0.6	1.62	1.37	3.6	57
1998	6	JP5	14.2	0	0	0	0	3
1998	7	JP5	49.3	0.6	1.06	1.01	1.9	17
1998	8	JP5	50.2	0.3	0.61	0.74	1.2	14

All fuel procured met specification limits.

Histogram: The mean decreased from 1.14% in 1997 to 0.95% in 1998. Histograms show no change in shape. Over 50% of the volume purchased in 1998 was within the 0.5% - 1.0% range.

Table: Average Olefinic content seems to be increasing for JP5 and decreasing for JP8, although content is lower in JP5 than for JP8. Region 3 (West Coast) produced the highest average aromatic content. Region 6 (Middle East) reported the average lowest content.

Table 6

**Values of JP8 for Olefins by Region**

(Volume in Millions of Gallons)

(Spec = 5.0% max)

Year	Region	Fuel	Volume	Min	Avg	WtAvg	Max	Count
1995	1	JP8	2.9	0.4	1.23	1.24	2.1	30
1995	2	JP8	126.6	0.7	2.32	2.38	5.0	83
1995	3	JP8	448.0	0.3	1.24	1.33	4.6	314
1995	4	JP8	10.0	0.5	1.00	1.05	2.9	16
1995	5	JP8	239.3	0.6	2.17	2.34	4.4	154
1995	7	JP8	65.1	0.2	0.51	0.55	1.1	21
1995	8	JP8	84.2	0.0	0.89	1.05	4.1	71
1996	1	JP8	18.8	0.6	1.02	0.95	1.9	60
1996	2	JP8	191.4	0.8	1.70	1.95	5.0	148
1996	3	JP8	620.6	0.1	1.18	1.18	4.3	422
1996	4	JP8	78.6	0.2	0.97	0.99	3.0	90
1996	5	JP8	426.6	0.4	1.88	2.31	5.0	224
1996	6	JP8	37.3	0.3	0.30	0.30	0.3	7
1996	7	JP8	249.2	0.1	0.62	0.50	1.3	101
1996	8	JP8	87.3	0.0	0.55	0.74	3.1	132
1997	1	JP8	91.4	0.6	1.88	2.30	4.6	97
1997	2	JP8	214.0	0.0	1.22	1.35	4.8	306
1997	3	JP8	799.9	0.0	1.15	1.17	4.6	658
1997	4	JP8	53.3	0.3	0.85	0.89	2.4	86
1997	5	JP8	421.5	0.3	1.49	2.00	4.7	286
1997	7	JP8	261.0	0.1	0.46	0.40	1.4	78
1997	8	JP8	301.5	0.0	0.38	0.20	3.5	170
1998	1	JP8	123.6	0.5	1.62	2.00	3.9	150
1998	2	JP8	215.8	0.0	1.23	1.33	4.8	272
1998	3	JP8	976.1	0.3	1.10	1.10	4.0	872
1998	4	JP8	60.2	0.4	1.21	1.13	4.2	112
1998	5	JP8	434.6	0.1	1.25	1.73	4.3	284
1998	6	JP8	6.7	0.3	0.30	0.30	0.3	1
1998	7	JP8	149.4	0.1	0.61	0.60	2.7	57
1998	8	JP8	262.3	0.0	0.62	0.36	4.5	204

All fuel procured met specification limits.

Histogram: The mean increased from 1.11% in 1997 to 1.36% in 1998. Histogram shapes a more definitive maximum at the 0.5% - 1.0% range in 1998 than for 1997.

Table: Region 6 (Middle East) reported the lowest average olefinic content. However, a small volume of product emanates from this source. It is interesting to note that the average olefinic content in the OCONUS Regions is lower than the CONUS Regions.

Table 7

**Values of JP5 for Total Sulfur by Region**

(Volume in Millions of Gallons)

(Spec = 0.40% max)

Year	Region	Fuel	Volume	Min	Avg	WtAvg	Max	Count
1995	3	JP5	55.5	0.000	0.0443	0.0513	0.110	33
1995	7	JP5	31.7	0.010	0.0138	0.0144	0.020	8
1996	3	JP5	308.9	0.000	0.0828	0.0838	0.140	111
1996	5	JP5	51.4	0.010	0.0120	0.0133	0.020	17
1996	6	JP5	22.7	0.010	0.0130	0.0140	0.019	3
1996	7	JP5	71.9	0.010	0.0352	0.0293	0.140	21
1996	8	JP5	39.6	0.010	0.0175	0.0174	0.030	8
1997	3	JP5	322.9	0.004	0.0915	0.0935	0.130	129
1997	5	JP5	210.8	0.000	0.0115	0.0126	0.150	74
1997	6	JP5	59.2	0.010	0.0100	0.0100	0.010	10
1997	7	JP5	55.8	0.004	0.0327	0.0253	0.150	19
1997	8	JP5	58.6	0.010	0.0330	0.0252	0.090	20
1998	3	JP5	310.8	0.030	0.0981	0.0993	0.140	125
1998	5	JP5	168.3	0.000	0.0255	0.0235	0.060	66
1998	6	JP5	24.1	0.010	0.0100	0.0100	0.010	5
1998	7	JP5	54.7	0.006	0.0454	0.0407	0.200	19
1998	8	JP5	57.9	0.001	0.0527	0.0364	0.120	15

All fuel purchased was within specification.

Histogram: Mean values and distribution were similar between 1997 and 1998. In 1998, 46.1% of the fuel was procured in the 0.00% - 0.05% range.

Table: Highest average sulfur was reported in Region 3 (Gulf Coast). Region 7 (Europe) has the highest maximum sulfur content.

Table 8

**Values of JP8 for Total Sulfur by Region**

(Volume in Millions of Gallons)

(Spec = 0.30% max)

Year	Region	Fuel	Volume	Min	Avg	WtAvg	Max	Count
1995	1	JP8	2.9	0.003	0.0143	0.0135	0.029	30
1995	2	JP8	126.6	0.029	0.0921	0.0873	0.260	83
1995	3	JP8	451.5	0	0.0506	0.0548	0.240	316
1995	4	JP8	10.0	0.010	0.0297	0.0300	0.060	16
1995	5	JP8	239.3	0	0.0368	0.0269	0.125	154
1995	7	JP8	65.1	0.008	0.0416	0.0451	0.160	21
1995	8	JP8	97.4	0.010	0.0725	0.0538	0.110	118
1996	1	JP8	18.8	0.007	0.0231	0.0308	0.050	60
1996	2	JP8	191.4	0.020	0.0851	0.0885	0.260	148
1996	3	JP8	633.7	0	0.0372	0.0378	0.210	433
1996	4	JP8	84.9	0.002	0.0300	0.0261	0.100	96
1996	5	JP8	426.6	0	0.0449	0.0290	0.200	224
1996	6	JP8	37.3	0.009	0.0099	0.0098	0.010	7
1996	7	JP8	263.1	0.001	0.0830	0.1060	0.280	111
1996	8	JP8	176.0	0.001	0.0670	0.0481	0.110	152
1997	1	JP8	91.4	0.006	0.0353	0.0422	0.074	97
1997	2	JP8	214.0	0	0.0885	0.0845	0.260	306
1997	3	JP8	799.9	0	0.0309	0.0347	0.160	658
1997	4	JP8	53.3	0.004	0.0281	0.0287	0.050	86
1997	5	JP8	421.5	0	0.0604	0.0322	0.200	286
1997	7	JP8	261.0	0.009	0.1001	0.1199	0.210	92
1997	8	JP8	301.5	0.001	0.0566	0.0495	0.120	170
1998	1	JP8	123.6	0.001	0.0227	0.0255	0.190	150
1998	2	JP8	215.8	0	0.0734	0.0659	0.145	272
1998	3	JP8	976.1	0	0.0375	0.0342	0.300	741
1998	4	JP8	60.2	0	0.0236	0.0255	0.101	112
1998	5	JP8	434.6	0	0.0808	0.0498	0.300	284
1998	6	JP8	6.7	0.01	0.01	0.01	0.010	1
1998	7	JP8	149.4	0.009	0.0743	0.0945	0.215	57
1998	8	JP8	262.3	0.0005	0.0652	0.0463	0.130	204

All fuel procured met specification limits.

Histogram: Two values in the histogram show up in the “0.30+” range for 1998. From the Table, one of the 0.30 values occurred in Region 3 (Gulf Coast) and Region 5 (West Coast). Volume of product procured within the 0.00% - 0.05% increased from 49.7% in 1997 to 59.6% in 1998.

Table: Highest average sulfur occurred in Region 7 (Europe). Region 6 (Middle East) reported very low total sulfur averages.

Table 9

**Values of JP5 for Mercaptan Sulfur by Region**

(Volume in Millions of Gallons)

(Spec = 0.002% max)

Year	Region	Fuel	Volume	Min	Avg	WtAvg	Max	Count
1995	3	JP5	55.5	0.0001	0.00057	0.00067	0.0015	33
1995	7	JP5	31.7	0.0002	0.00020	0.00002	0.0002	1
1996	3	JP5	308.9	0.0001	0.00098	0.00099	0.0020	111
1996	5	JP5	30.2	0.0007	0.00105	0.00101	0.0017	6
1996	6	JP5	2.6	0.0004	0.00040	0.00005	0.0004	1
1996	7	JP5	40.5	0.0001	0.00050	0.00051	0.0017	14
1996	8	JP5	39.6	0.0009	0.00090	0.00090	0.0009	8
1997	3	JP5	322.9	0.0001	0.00072	0.00073	0.0013	129
1997	5	JP5	146.9	0.0001	0.00064	0.00073	0.0020	29
1997	7	JP5	34.0	0.0001	0.00019	0.00016	0.0006	13
1997	8	JP5	55.0	0.0001	0.00077	0.00086	0.0009	15
1998	3	JP5	310.8	0.0001	0.00099	0.00100	0.0020	125
1998	5	JP5	96.8	0.0001	0.00039	0.00051	0.0020	32
1998	7	JP5	32.1	0.0001	0.00039	0.00039	0.0014	14
1998	8	JP5	57.9	0.0006	0.00079	0.00086	0.0009	14

All fuel procured met specifications.

This test is not required if the Doctor Test is “Negative”. Higher average mercaptan sulfur values were reported for JP8 than for JP5.

Histogram: Four values were at the maximum of 0.002%. Over half of the fuel procured (55.7%) had mercaptan sulfur in the range of 0.0010% - 0.0015%, as compared to 30.5% in 1997.

Table: Average mercaptan sulfur values seem to be steady. Region 7 (Europe) has the lowest mercaptan sulfur. Region 3 (Gulf Coast) and Region 8 (Middle East) had the highest levels of average values of mercaptan sulfur.

Table 10

**Values of JP8 for Mercaptan Sulfur by Region**

(Volume in Millions of Gallons)

(Spec = 0.002% max)

Year	Region	Fuel	Volume	Min	Avg	WtAvg	Max	Count
1995	1	JP8	1.5	0.0001	0.00013	0.00013	0.0003	13
1995	2	JP8	61.0	0.0007	0.00136	0.00133	0.0020	42
1995	3	JP8	303.6	0.0001	0.00099	0.00113	0.0020	240
1995	4	JP8	4.2	0.0010	0.00154	0.00158	0.0020	7
1995	5	JP8	237.8	0.0001	0.00054	0.00066	0.0019	151
1995	7	JP8	57.3	0.0001	0.00093	0.00110	0.0025	20
1995	8	JP8	55.1	0.0003	0.00056	0.00059	0.0008	92
1996	1	JP8	14.3	0.0003	0.00095	0.00076	0.0018	11
1996	2	JP8	137.3	0.0001	0.00127	0.00126	0.0020	117
1996	3	JP8	344.4	0.0001	0.00115	0.00123	0.0099	293
1996	4	JP8	51.9	0.0010	0.00173	0.00175	0.0030	70
1996	5	JP8	396.8	0.0001	0.00051	0.00060	0.0020	173
1996	6	JP8	37.3	0.0003	0.00037	0.00038	0.0004	7
1996	7	JP8	242.7	0.0001	0.00124	0.00125	0.0029	103
1996	8	JP8	63.8	0.0001	0.00054	0.00053	0.0020	125
1997	1	JP8	86.6	0.0001	0.00018	0.00017	0.0014	57
1997	2	JP8	197.2	0.0001	0.00123	0.00126	0.0040	295
1997	3	JP8	799.9	0.0001	0.00097	0.00095	0.0071	381
1997	4	JP8	52.9	0.0002	0.00171	0.00178	0.0030	85
1997	5	JP8	333.9	0.0001	0.00065	0.00079	0.0021	136
1997	7	JP8	260.5	0.0000	0.00101	0.00109	0.0025	91
1997	8	JP8	51.1	0.0004	0.00059	0.00059	0.0010	86
1998	1	JP8	119.0	0.0001	0.00032	0.00029	0.0017	83
1998	2	JP8	186.4	0.0001	0.00085	0.00079	0.0020	252
1998	3	JP8	684.3	0.0000	0.00078	0.00054	0.0023	568
1998	4	JP8	60.2	0.0002	0.00146	0.00150	0.0030	112
1998	5	JP8	377.4	0.0002	0.00087	0.00076	0.0020	121
1998	6	JP8	6.7	0.0004	0.00040	0.00040	0.0004	1
1998	7	JP8	149.4	0.0000	0.00083	0.00091	0.0020	57
1998	8	JP8	262.3	0.0002	0.00058	0.00024	0.0018	158

All fuel procured met specification limits.

Histogram: The mean value showed a slight decrease from 0.0010% in 1997 to 0.0008% in 1998.

Volume of fuel procured in the 0.0000% - 0.0015% decreased from 87.2% in 1997 to 81.4% in 1998.

Table: Region 4 (West Central) and Region 2 (East Central) had the highest average mercaptan sulfur content. The lowest average contents were reported in Region 1 (East Coast). In Region 7 (Europe), the volumetrically-weighted average continues a declining trend.

Table 11

**Values of JP5 for Particulate Contamination by Region**

(Volume in Millions of Gallons)

(Spec = 1.0 mg/L max)

Year	Region	Fuel	Volume	Min	Avg	WtAvg	Max	Count
1995	3	JP5	55.5	0.03	0.316	0.234	1.0	33
1995	7	JP5	31.7	0.02	0.325	0.304	0.6	8
1996	3	JP5	308.9	0.03	0.145	0.145	0.8	110
1996	5	JP5	51.4	0.04	0.235	0.151	1.0	16
1996	6	JP5	22.7	0.26	0.360	0.307	0.5	3
1996	7	JP5	71.9	0.2	0.497	0.465	1.0	21
1996	8	JP5	39.6	0.4	0.650	0.659	0.9	8
1997	3	JP5	322.9	0.03	0.196	0.194	0.7	129
1997	5	JP5	210.8	0	0.171	0.137	0.6	74
1997	6	JP5	59.2	0.18	0.293	0.278	0.5	10
1997	7	JP5	55.8	0.13	0.436	0.405	0.8	19
1997	8	JP5	58.6	0.1	0.386	0.441	0.7	20
1998	3	JP5	310.8	0.05	0.234	0.186	2.0	125
1998	5	JP5	168.3	0	0.286	0.264	1.0	66
1998	6	JP5	24.1	0.2	0.217	0.212	0.3	5
1998	7	JP5	54.7	0.15	0.520	0.510	1.0	19
1998	8	JP5	57.9	0.1	0.485	0.497	0.9	15

All fuel met specifications in 1998 except for one delivery of JP5 to MCAS Cherry Point with a value of 2.0 mg/L.

Histogram: Slight shift in the maximum for 1997 (0.0-0.2 range) to 1998 (0.2-0.4 range).

Table: Fuel from Region 7 (Europe) and 8 (Pacific) tend to report higher average particulate content than the CONUS Regions.



Table 12

**Values of JP8 for Particulate Contamination by Region**

(Volume in Millions of Gallons)

(Spec = 1.0 mg/L max)

Year	Region	Fuel	Volume	Min	Avg	WtAvg	Max	Count
1995	1	JP8	2.9	0.10	0.320	0.293	0.7	30
1995	2	JP8	126.6	0.10	0.444	0.466	1	83
1995	3	JP8	451.5	0.03	0.335	0.311	1	312
1995	4	JP8	10.0	0.05	0.416	0.475	1	16
1995	5	JP8	239.3	0.10	0.189	0.271	1	154
1995	7	JP8	65.1	0.12	0.495	0.470	0.8	21
1995	8	JP8	97.4	0.05	0.355	0.364	0.98	116
1996	1	JP8	18.8	0.05	0.206	0.284	1	60
1996	2	JP8	191.4	0.05	0.435	0.427	0.98	147
1996	3	JP8	633.7	0.013	0.346	0.298	1.2	428
1996	4	JP8	84.9	0.1	0.359	0.397	0.9	96
1996	5	JP8	426.6	0.01	0.280	0.327	1	224
1996	6	JP8	37.3	0.48	0.561	0.562	0.61	7
1996	7	JP8	263.1	0.03	0.342	0.391	1	100
1996	8	JP8	176.0	0.05	0.378	0.555	1	152
1997	1	JP8	91.4	0	0.184	0.186	1	97
1997	2	JP8	214.0	0.03	0.446	0.401	1	306
1997	3	JP8	799.9	0	0.340	0.316	1	658
1997	4	JP8	53.3	0.01	0.316	0.327	1	86
1997	5	JP8	421.5	0	0.286	0.346	1	286
1997	7	JP8	261.00	0.03	0.353	0.393	0.9	83
1997	8	JP8	301.5	0.05	0.434	0.580	1.1	170
1998	1	JP8	123.6	0	0.225	0.366	0.8	150
1998	2	JP8	215.8	0.02	0.436	0.420	1.0	272
1998	3	JP8	976.1	0	0.300	0.316	0.9	741
1998	4	JP8	60.2	0.1	0.316	0.332	0.9	112
1998	5	JP8	434.6	0.03	0.314	0.350	1.0	284
1998	6	JP8	6.7	0.79	0.790	0.790	0.8	1
1998	7	JP8	149.4	0.05	0.374	0.416	1.0	57
1998	8	JP8	262.3	0.09	0.425	0.500	2.1	204

All fuel procured met specification limits except for two out-of-tolerance reports from Korea in 1998. Eleven results were at the specification limit of 1.0 mg/L.

Histogram: The mean values stayed the same for 1997 and 1998. Histograms show no change in shape.

Table: Regions 2 (East Coast), 6 (Middle East), 7 (Europe) and 8 (Pacific) reported the highest average particulate content.

Table 13

**Values of JP5 for Filtration Time by Region**

(Volume in Millions of Gallons)

(Spec = 15 minutes max)

Year	Region	Fuel	Volume	Min	Avg	WtAvg	Max	Count
1995	3	JP5	55.5	2	5.2	3.8	15	33
1995	7	JP5	31.7	4	4.6	4.7	6	8
1996	3	JP5	308.9	2	3.1	3.1	6	111
1996	5	JP5	51.4	3	3.7	3.5	4	17
1996	6	JP5	22.7	8	8.7	8.9	10	3
1996	7	JP5	71.9	4	5.3	5.3	7	21
1996	8	JP5	39.6	3	4.4	4.4	7	8
1997	3	JP5	322.9	2	3.3	3.1	8	129
1997	5	JP5	210.8	3	4.4	4.2	12	74
1997	6	JP5	59.2	7	8.7	8.6	10	10
1997	7	JP5	55.8	4	6.5	6.7	11	19
1997	8	JP5	58.6	3	6.2	5.9	15	20
1998	3	JP5	310.8	2	3.2	3.1	9	125
1998	5	JP5	168.3	3	5.8	5.6	15	66
1998	6	JP5	24.1	10	11.4	11.6	13	5
1998	7	JP5	54.7	4	6.7	6.7	12	19
1998	8	JP5	57.9	3	5.2	5.1	7	15

All fuel procured met specification limits.

Histogram: No change in shape or mean values from 1997 to 1998. One value reported at the specification maximum limit of 15 minutes.

Table: Region 6 (Middle East) has the highest filtration time averages. Trend for average filtration time for Region 7 (Europe) is showing a slight increase.

Table 14

**Values of JP8 for Filtration Time by Region**

(Volume in Millions of Gallons)

(Spec = 15 minutes max)

Year	Region	Fuel	Volume	Min	Avg	WtAvg	Max	Count
1995	1	JP8	2.9	6	7.1	7.0	10	30
1995	2	JP8	126.6	3	7.3	7.0	13	82
1995	3	JP8	451.5	3	6.3	5.9	14	310
1995	4	JP8	10.0	6	8.1	8.0	10	16
1995	5	JP8	239.3	4	5.6	5.8	12	154
1995	7	JP8	65.1	4	7.0	7.4	13	21
1995	8	JP8	97.4	4	6.7	6.3	11	118
1996	1	JP8	18.8	3	7.1	4.3	12	60
1996	2	JP8	191.4	3	7.8	7.7	13	148
1996	3	JP8	633.7	3	6.4	6.4	13	429
1996	4	JP8	84.9	4	7.2	7.0	11	96
1996	5	JP8	426.6	3	6.4	7.1	14	224
1996	6	JP8	37.3	8	8.3	8.3	9	7
1996	7	JP8	263.1	3	6.5	6.7	14	101
1996	8	JP8	176.0	4	7.2	7.0	14	152
1997	1	JP8	91.4	4	7.4	6.8	11	97
1997	2	JP8	214.0	3	7.4	7.2	14	306
1997	3	JP8	799.9	4	6.4	6.7	14	658
1997	4	JP8	53.3	5	7.5	7.3	14	86
1997	5	JP8	421.5	3	5.2	6.3	15	286
1997	7	JP8	261.0	4	7.6	7.1	14	83
1997	8	JP8	301.5	4	6.7	7.3	11	170
1998	1	JP8	123.6	4	7.5	7.0	12	150
1998	2	JP8	216.0	3	7.6	7.6	15	272
1998	3	JP8	927.6	3	6.9	7.6	15	872
1998	4	JP8	60.2	4	8.4	8.4	14	112
1998	5	JP8	434.6	2	5.4	6.7	15	284
1998	6	JP8	6.7	10	10	10	10	1
1998	7	JP8	149.4	5	7.5	7.3	12	57
1998	8	JP8	262.3	4	6.6	6.4	13	204

All fuel procured met specification limits. Five results reported at the maximum of 15 minutes.

Histogram: Mean values, standard deviation and general shape of the histogram are similar to 1997.

Table: Region 5 (West Coast) reported the lowest average filtration time. Region 6 (Middle East) reported the highest average filtration time.

Table 15

**Values of JP5 for Total Acid Number by Region**

(Volume in Millions of Gallons)  
(Spec = 0.015 mg KOH/g max)

Year	Region	Fuel	Volume	Min	Avg	WtAvg	Max	Count
1995	3	JP5	55.5	0.001	0.0050	0.0038	0.011	33
1995	7	JP5	31.8	0.004	0.006	0.0059	0.009	8
1996	3	JP5	308.9	0.0005	0.0032	0.0031	0.013	110
1996	5	JP5	51.4	0.003	0.0056	0.0062	0.014	17
1996	6	JP5	22.7	0.003	0.0039	0.0033	0.006	3
1996	7	JP5	71.9	0.003	0.0048	0.0049	0.009	21
1996	8	JP5	39.6	0.003	0.0047	0.0048	0.007	8
1997	3	JP5	322.9	0.001	0.0031	0.0030	0.009	129
1997	5	JP5	210.8	0.001	0.0050	0.0060	0.015	73
1997	6	JP5	59.2	0.003	0.0044	0.0047	0.008	10
1997	7	JP5	55.8	0.001	0.0051	0.0054	0.008	19
1997	8	JP5	58.6	0.001	0.0071	0.0061	0.020	20
1998	3	JP5	310.8	0.001	0.0029	0.0029	0.012	125
1998	5	JP5	168.3	0.001	0.0055	0.0054	0.014	66
1998	6	JP5	24.1	0.003	0.0046	0.0049	0.008	5
1998	7	JP5	54.7	0.003	0.0049	0.0053	0.007	19
1998	8	JP5	57.9	0.003	0.0089	0.0060	0.019	15

All fuel procured except for 5 deliveries from Alaska (Region 8) met specification limits for 1998.

Histogram: Mean acid number increased from 0.0042 mg KOH/g in 1997 to 0.0052 mg KOH/g in 1998. Acid numbers from Alaska were in the 0.018 – 0.019 mg KOH/g range.

Table: Region 3 (Gulf Coast) produced the lowest maximum acid number values. Region 8 (Pacific) reports the highest average acid numbers, but these results are skewed by the Alaska values.

Table 16

**Values of JP8 for Total Acid Number by Region**

(Volume in Millions of Gallons)  
(Spec = 0.015 mg KOH/g max)

Year	Region	Fuel	Volume	Min	Avg	WtAvg	Max	Count
1995	1	JP8	2.9	0.001	0.0024	0.0023	0.010	30
1995	2	JP8	126.6	0.002	0.0053	0.0053	0.012	83
1995	3	JP8	451.5	0.001	0.0035	0.0034	0.012	316
1995	4	JP8	10.0	0.003	0.0065	0.0063	0.013	16
1995	5	JP8	239.3	0.001	0.0025	0.0028	0.013	154
1995	7	JP8	65.1	0.002	0.0047	0.0050	0.009	21
1995	8	JP8	97.4	0.001	0.0148	0.0114	0.020	118
1996	1	JP8	18.8	0.001	0.0041	0.0066	0.012	60
1996	2	JP8	191.4	0.001	0.0053	0.0055	0.014	146
1996	3	JP8	633.7	0.0001	0.0044	0.0039	0.040	433
1996	4	JP8	84.9	0.001	0.0057	0.0055	0.015	95
1996	5	JP8	426.6	0.001	0.0038	0.0040	0.015	224
1996	6	JP8	37.3	0.005	0.0059	0.0059	0.006	7
1996	7	JP8	263.1	0.001	0.0053	0.0055	0.015	111
1996	8	JP8	176.0	0.001	0.0040	0.0085	0.020	152
1997	1	JP8	91.4	0.001	0.0063	0.0077	0.015	97
1997	2	JP8	214.0	0.0002	0.0043	0.0047	0.014	306
1997	3	JP8	799.9	0.0006	0.0076	0.0038	0.14	658
1997	4	JP8	53.3	0.001	0.0060	0.0062	0.014	86
1997	5	JP8	421.5	0.001	0.0045	0.0040	0.013	285
1997	7	JP8	261.0	0.001	0.0035	0.0039	0.0095	92
1997	8	JP8	301.5	0.001	0.0125	0.0093	0.020	170
1998	1	JP8	123.6	0.001	0.0079	0.0112	0.015	150
1998	2	JP8	215.8	0.001	0.0045	0.0041	0.014	272
1998	3	JP8	976.1	0.000	0.0057	0.0041	0.015	872
1998	4	JP8	60.2	0.001	0.0065	0.0066	0.014	112
1998	5	JP8	434.6	0.001	0.0044	0.0037	0.014	284
1998	6	JP8	6.7	0.006	0.006	0.006	0.006	1
1998	7	JP8	149.4	0.001	0.0034	0.0036	0.009	57
1998	8	JP8	262.3	0.001	0.0125	0.0092	0.020	204

For 1998, there were 111 reports of JP8 with acid numbers between 0.016 and 0.020 mg KOH/g.

Histogram: No change in mean values or shape of the histogram between 1997 and 1998.

Table: No obvious trends noted, except Region 8 (Pacific) has the highest average total acid number. This region includes Alaska and is skewing the results.

Table 17

**Values of JP5 for Smoke Point by Region**

(Volume in Millions of Gallons)

(Spec = 19.0 mm max)

Year	Region	Fuel	Volume	Min	Avg	WtAvg	Max	Count
1995	3	JP5	55.5	19	21.25	5.44	25	14
1995	7	JP5	31.7	21	21	9.19	21	3
1996	3	JP5	308.9	18	19.95	15.18	22	87
1996	5	JP5	51.4	19.3	19.98	20.17	21	17
1996	6	JP5	22.75	21	24.33	23.45	27	3
1996	7	JP5	71.9	21	22.38	16.40	25	16
1996	8	JP5	39.6	21	23.00	23.01	24	8
1997	3	JP5	322.9	19	20.68	20.31	26	129
1997	5	JP5	210.8	19	19.95	20.21	22.5	74
1997	6	JP5	59.2	21	22.40	22.19	24	10
1997	7	JP5	55.8	21	22.26	21.92	25	19
1997	8	JP5	58.6	19.7	23.28	23.30	25	20
1998	3	JP5	310.8	19	20.55	20.32	26	125
1998	5	JP5	168.3	19	19.49	19.56	20.5	66
1998	6	JP5	24.1	21	21.60	21.49	23	5
1998	7	JP5	54.7	21	22.68	22.06	25	19
1998	8	JP5	57.9	19.2	22.43	23.25	25	15

All fuels procured met specification limits for 1998

Histogram: No change in shape of histogram or in mean values from 1997 to 1998.

Table: No apparent trends for JP5. Highest average smoke points occur in the OCONUS regions.

Table 18

**Values of JP8 for Smoke Point by Region**

(Volume in Millions of Gallons)

(Spec = 25 mm min or 19 min w/ 3.0% Naphthalenes)

Year	Region	Fuel	Volume	Min	Avg	WtAvg	Max	Count
1995	1	JP8	2.9	20.2	22.30	22.42	28.8	30
1995	2	JP8	126.6	20	24.33	24.00	26	82
1995	3	JP8	451.5	20	22.98	22.28	33	314
1995	4	JP8	10.0	21	23.32	23.62	27	16
1995	5	JP8	239.3	19	20.24	20.68	23	154
1995	7	JP8	65.1	19	25.29	25.37	29	21
1995	8	JP8	97.4	19.5	21.13	21.19	28.4	117
1996	1	JP8	18.8	20	21.60	22.36	23.1	60
1996	2	JP8	191.4	20	24.51	24.29	27.7	148
1996	3	JP8	633.7	19	23.22	22.14	30	433
1996	4	JP8	84.9	20	24.47	24.47	29	96
1996	5	JP8	426.6	19	20.28	20.58	27	224
1996	6	JP8	37.3	27	27.00	27.00	27	7
1996	7	JP8	263.1	19	23.57	24.37	27	111
1996	8	JP8	176.0	19.5	22.01	23.45	25	152
1997	1	JP8	91.4	20	21.39	21.29	25	97
1997	2	JP8	214.0	19	25.29	24.93	29	306
1997	3	JP8	799.9	19	23.41	22.15	29	658
1997	4	JP8	53.3	21	26.11	26.84	29	86
1997	5	JP8	421.5	19	20.09	20.56	25	286
1997	7	JP8	261.0	19	24.49	24.76	27	92
1997	8	JP8	301.5	19.4	21.76	23.15	26.2	170
1998	1	JP8	123.6	19.2	21.43	21.88	25	150
1998	2	JP8	215.8	19	24.78	24.06	29	272
1998	3	JP8	976.1	19	23.24	22.18	34	872
1998	4	JP8	60.2	21	26.13	26.81	29.7	112
1998	5	JP8	434.6	19	20.09	20.42	24	284
1998	6	JP8	6.7	27	27	27	27	1
1998	7	JP8	149.4	22	24.61	24.63	26	57
1998	8	JP8	262.3	19.2	22.15	23.60	28	204

All fuel procured met specification limits.

Histogram: No change in shape of histogram or mean values from 1997 to 1998.

Table: No obvious trends. Region 4 (West Central) reported the second highest average smoke point. Region 6 (Middle East), when reporting, provides the highest smoke point values.

Table 19

**Values of JP8 for Naphthalene by Region**

(Volume in Millions of Gallons)

(Spec = 3.0% max)

Year	Region	Fuel	Volume	Min	Avg	WtAvg	Max	Count
1995	1	JP8	2.9	0.5	0.89	0.87	1.7	30
1995	2	JP8	94.2	0.8	1.23	0.21	2.0	62
1995	3	JP8	450.9	0.1	1.24	1.13	2.9	315
1995	4	JP8	5.1	0.1	0.66	0.79	1.1	9
1995	5	JP8	239.3	0.2	1.79	1.36	3.0	154
1995	7	JP8	32.1	0.2	1.55	0.97	3.0	10
1995	8	JP8	97.4	0.1	2.14	1.64	2.9	118
1996	1	JP8	18.8	0.8	1.38	2.00	2.9	60
1996	2	JP8	148.1	0.6	1.33	1.33	2.9	116
1996	3	JP8	583.8	0.1	1.28	1.12	3.0	383
1996	4	JP8	35.3	0.0	0.92	0.98	1.7	27
1996	5	JP8	416.6	0.1	1.38	0.90	3.0	222
1996	6	JP8	27.3	0.5	0.52	0.52	0.5	5
1996	7	JP8	130.1	0.1	1.55	1.54	2.9	76
1996	8	JP8	162.1	0.3	2.16	1.15	3.0	135
1997	1	JP8	91.4	0.9	1.38	1.57	3.0	97
1997	2	JP8	161.5	0.1	1.31	1.28	1.7	180
1997	3	JP8	695.6	0.1	1.06	1.08	3.5	423
1997	4	JP8	2.4	0.0	0.28	0.05	1.3	14
1997	5	JP8	410.5	0.1	1.79	1.04	3.0	282
1997	7	JP8	129.9	0.1	1.54	1.56	2.9	60
1997	8	JP8	301.5	0.1	1.67	1.16	2.9	170
1998	1	JP8	121.9	0.0	1.38	1.56	2.2	122
1998	2	JP8	135.0	0.1	1.26	1.23	2.1	122
1998	3	JP8	845.8	0.0	1.17	1.13	2.3	579
1998	4	JP8	2.8	0.1	0.51	0.51	1.0	18
1998	5	JP8	434.6	0.2	1.99	1.27	2.8	284
1998	6	JP8	6.7	0.5	0.53	0.53	0.5	1
1998	7	JP8	102.3	0.1	1.23	1.18	3.0	46
1998	8	JP8	194.7	0.1	2.18	1.63	2.9	146

One result reported at the maximum of 3.0%. All other product within specification limits Naphthalenes are reported for JP8 only when the smoke point is below 25 mm.

Histogram: No change in mean values or shape of the histogram from 1997 to 1998.

Table: Region 8 (Pacific) reports the highest average Naphthalene content. Region 4 (West Coast) and Region 6 (Middle East) report the lowest average naphthalene content. Maximum Naphthalene content for the Region 1 (East Coast) and Region 3 (Gulf Coast) are decreasing from 1997 to 1998.



Table 20

***Values of JP5 for Hydrogen Content by Region***

(Volume in Millions of Gallons)

(Spec = 13.4% min)

Year	Region	Fuel	Volume	Min	Avg	WtAvg	Max	Count
1995	3	JP5	55.5	13.6	13.86	13.84	14.1	33
1995	7	JP5	31.7	13.7	13.85	13.86	14.0	8
1996	3	JP5	308.9	13.5	13.94	13.95	14.6	111
1996	5	JP5	51.4	13.4	13.60	13.70	14.4	17
1996	6	JP5	22.7	13.7	13.92	13.81	14.3	3
1996	7	JP5	71.9	13.4	14.03	14.01	15.1	21
1996	8	JP5	39.6	13.7	13.81	13.81	13.9	8
1997	3	JP5	322.9	13.4	13.97	13.97	14.4	129
1997	5	JP5	210.8	13.4	13.58	13.65	14.1	74
1997	6	JP5	59.2	13.6	13.78	13.75	14.0	10
1997	7	JP5	55.8	13.6	13.81	13.82	14.1	19
1997	8	JP5	58.6	13.6	13.84	13.78	14.1	20
1998	3	JP5	310.8	13.4	13.95	13.96	14.7	125
1998	5	JP5	168.3	13.4	13.59	13.57	15.3	66
1998	6	JP5	24.1	13.6	13.62	13.62	13.7	5
1998	7	JP5	54.7	13.4	13.89	13.86	14.1	19
1998	8	JP5	57.9	13.8	13.93	13.93	14.2	15

All fuel procured met specification limits.

Histogram: No change in histogram or mean value from 1997 to 1998.

Table: There are no apparent trends for both JP5 and JP8. Average content for JP8 is about the same as for JP5 and is consistent.

Table 21

**Values of JP8 for Hydrogen Content by Region**

(Volume in Millions of Gallons)

(Spec = 13.4% min)

Year	Region	Fuel	Volume	Min	Avg	WtAvg	Max	Count
1995	1	JP8	2.9	13.5	13.60	13.61	13.8	30
1995	2	JP8	126.6	13.6	13.87	13.87	14.1	83
1995	3	JP8	451.5	13.4	13.79	13.79	14.5	316
1995	4	JP8	10.0	13.6	13.81	13.83	14.0	16
1995	5	JP8	239.3	13.4	13.56	13.62	14.5	154
1995	7	JP8	65.1	13.7	13.89	13.90	14.2	21
1995	8	JP8	97.4	13.5	13.80	13.84	14.2	118
1996	1	JP8	18.8	13.5	13.64	13.79	14.3	60
1996	2	JP8	191.4	13.5	13.88	13.87	14.8	148
1996	3	JP8	633.7	13.4	13.78	13.74	14.7	433
1996	4	JP8	84.9	13.4	13.80	13.78	14.1	96
1996	5	JP8	426.6	13.4	13.62	13.69	14.2	224
1996	6	JP8	37.3	14.0	14.08	14.08	14.2	7
1996	7	JP8	263.1	13.4	13.87	13.95	15.0	111
1996	8	JP8	176.0	13.4	13.88	13.95	14.2	152
1997	1	JP8	91.4	13.5	13.86	13.83	14.0	97
1997	2	JP8	214.0	13.4	13.89	13.88	14.4	306
1997	3	JP8	799.9	12.9	15.87	14.16	13.9	658
1997	4	JP8	53.3	13.6	13.85	13.89	14.0	86
1997	5	JP8	421.5	13.4	13.54	13.63	13.9	286
1997	7	JP8	261.0	13.5	14.02	14.01	15.2	92
1997	8	JP8	301.5	13.4	13.92	13.90	14.1	170
1998	1	JP8	123.6	13.4	13.69	13.78	14.0	150
1998	2	JP8	215.8	13.4	13.94	13.86	15.0	272
1998	3	JP8	976.1	13.4	16.98	14.37	13.9	871
1998	4	JP8	60.2	13.6	13.85	13.88	14.1	112
1998	5	JP8	434.6	13.4	13.57	13.65	14.6	284
1998	6	JP8	6.7	14.0	14.00	14.00	14.0	1
1998	7	JP8	149.4	13.1	13.90	13.92	14.2	57
1998	8	JP8	262.3	13.6	13.92	13.94	14.4	204

All fuel procured met specification limits.

Histogram: No change histogram shape or in mean values from 1997 to 1998.

Table: Region 6 (Middle East) reported the highest average hydrogen content of just above 14%.

Table 22

***Values of JP5 for Distillation 10% Recovered by Region***

(Volume in Millions of Gallons)

(Spec = 205°C max, “R” Revision = 206°C max)

Year	Region	Fuel	Volume	Min	Avg	WtAvg	Max	Count
1995	3	JP5	55.5	171	181.93	178.43	198	33
1995	7	JP5	31.7	186	195.99	195.10	203	8
1996	3	JP5	308.9	169	173.44	173.14	194	111
1996	5	JP5	51.4	169	190.71	185.27	200	17
1996	6	JP5	22.7	164	181.33	187.05	190	3
1996	7	JP5	71.9	187	191.48	191.14	200	21
1996	8	JP5	39.6	186	189.07	189.06	195	8
1997	3	JP5	322.9	156	174.06	172.63	201	129
1997	5	JP5	210.8	170	191.49	183.99	202	74
1997	6	JP5	59.2	189	191.30	191.48	193	10
1997	7	JP5	55.8	180	193.36	192.69	202	19
1997	8	JP5	58.6	189	192.81	193.40	198	20
1998	3	JP5	310.8	150	174.34	173.57	201	125
1998	5	JP5	168.3	176	195.09	192.60	205	66
1998	6	JP5	24.1	194	195.00	197.07	197	5
1998	7	JP5	54.7	186	193.93	191.42	201	19
1998	8	JP5	57.9	191	194.10	194.15	195	15

All fuel procured met specification limits for 1998.

Histogram: No histogram for this property.

Table: Region 3 (Gulf Coast) produces product with the lowest average 10% recovered.

Table 23

**Values of JP8 for Distillation 10% Recovered by Region**

(Volume in Millions of Gallons)

(Spec = 205°C max)

Year	Region	Fuel	Volume	Min	Avg	WtAvg	Max	Count
1995	1	JP8	2.9	177	185.40	184.91	197	30
1995	2	JP8	126.6	176	182.91	182.85	191	83
1995	3	JP8	451.5	150	180.68	178.65	194	316
1995	4	JP8	10.0	171	178.38	178.01	188	16
1995	5	JP8	239.3	141	154.14	158.60	190	154
1995	7	JP8	65.1	164	176.79	178.28	198	21
1995	8	JP8	97.4	160	167.49	166.01	175	118
1996	1	JP8	18.8	167	183.93	174.41	197	60
1996	2	JP8	191.4	168	179.79	180.21	191	148
1996	3	JP8	633.7	157	179.39	179.43	197	433
1996	4	JP8	84.9	152	170.04	170.09	188	96
1996	5	JP8	426.6	148	166.95	164.01	198	224
1996	6	JP8	37.3	162	165.29	165.03	168	7
1996	7	JP8	263.1	164	172.41	172.75	193	111
1996	8	JP8	176.0	158	165.85	166.71	183	152
1997	1	JP8	91.4	168	178.92	176.73	191	97
1997	2	JP8	214.0	172	181.48	181.42	197	306
1997	3	JP8	799.9	126	174.86	177.05	200	658
1997	4	JP8	53.3	156	167.06	165.02	193	86
1997	5	JP8	421.5	148	171.53	167.34	201	286
1997	7	JP8	261.0	152	171.74	171.83	193	92
1997	8	JP8	301.5	157	167.37	170.52	195	170
1998	1	JP8	123.6	166	178.67	172.78	195	150
1998	2	JP8	215.8	167	183.37	182.85	197	272
1998	3	JP8	976.1	83	180.11	181.13	201	741
1998	4	JP8	60.2	158	172.39	169.06	186	112
1998	5	JP8	434.6	148	168.32	165.96	199	284
1998	6	JP8	6.7	170	170.00	170.00	170	1
1998	7	JP8	149.4	157	174.35	174.22	190	57
1998	8	JP8	262.3	154	166.93	169.92	182	204

All fuel procured met specification limits.

Histogram: No histogram for this property.

Table: Region 2 (East Central) and Region 3 (Gulf Coast) produced product with the highest average 10% recovered. Region 5 (West Coast) and Region 8 (Pacific) produced product with the lowest average 10% recovered.

Table 24

**Values of JP5 for Final Boiling Point by Region**

(Volume in Millions of Gallons)

(Spec = 300°C max)

Year	Region	Fuel	Volume	Min	Avg	WtAvg	Max	Count
1995	3	JP5	55.5	246	269.04	273.03	287	33
1995	7	JP5	31.7	244	255.05	254.38	262	8
1996	3	JP5	308.9	254	278.33	278.22	286	111
1996	5	JP5	51.4	255	274.88	285.57	312	17
1996	6	JP5	22.7	250	266.67	258.99	290	3
1996	7	JP5	71.9	233	250.90	250.41	261	21
1996	8	JP5	39.6	253	262.35	262.22	274	8
1997	3	JP5	322.9	263	279.34	279.73	289	129
1997	5	JP5	210.8	250	275.24	290.15	309	74
1997	6	JP5	59.2	259	266.40	266.74	278	10
1997	7	JP5	55.8	234	255.76	255.67	273	19
1997	8	JP5	58.6	238	252.52	247.00	280	20
1998	3	JP5	310.8	262	279.46	279.61	289	128
1998	5	JP5	168.3	244	263.20	269.05	314	66
1998	6	JP5	24.1	281	281.60	281.71	283	5
1998	7	JP5	54.7	232	248.08	249.31	266	19
1998	8	JP5	57.9	236	252.43	245.35	281	15

Region 5 (West Coast) had 4 values above the 300°C maximum limit in 1998.

Histogram: No histogram for this property.

Table: Region 7 (Europe) and Region 8 (Pacific) produced product with the lowest average final boiling point.

Table 25

**Values of JP8 for Final Boiling Point by Region**

(Volume in Millions of Gallons)

(Spec = 300°C max)

Year	Region	Fuel	Volume	Min	Avg	WtAvg	Max	Count
1995	1	JP8	2.9	256	265.10	264.68	279	30
1995	2	JP8	126.6	246	255.33	255.31	272	83
1995	3	JP8	451.5	214	263.49	265.11	283	316
1995	4	JP8	10.0	236	255.38	256.53	289	16
1995	5	JP8	239.3	209	301.57	293.65	330	154
1995	7	JP8	65.1	233	246.72	248.49	261	21
1995	8	JP8	97.4	264	274.87	277.45	296	118
1996	1	JP8	18.8	250	261.68	256.95	272	60
1996	2	JP8	191.4	221	255.07	255.07	275	148
1996	3	JP8	633.7	238	261.88	264.22	284	433
1996	4	JP8	84.9	235	260.47	262.35	276	96
1996	5	JP8	426.6	255	289.62	291.97	319	224
1996	6	JP8	37.3	278	282.14	282.25	288	7
1996	7	JP8	263.1	231	255.19	255.19	300	111
1996	8	JP8	176.0	248	272.92	271.21	290	152
1997	1	JP8	91.4	234	254.80	251.13	278	97
1997	2	JP8	214.0	232	254.89	254.73	285	306
1997	3	JP8	799.9	220	259.44	263.62	300	658
1997	4	JP8	53.3	237	262.81	263.70	295	86
1997	5	JP8	421.5	242	280.19	284.85	313	286
1997	7	JP8	261.0	236	256.83	256.84	276	92
1997	8	JP8	301.5	257	275.54	274.03	293	170
1998	1	JP8	123.6	242	257.29	251.21	292	150
1998	2	JP8	215.8	234	254.79	256.85	288	272
1998	3	JP8	976.1	220	260.98	265.10	290	872
1998	4	JP8	60.2	235	257.68	260.25	273	112
1998	5	JP8	434.6	238	275.40	287.62	316	284
1998	6	JP8	6.7	258	258.00	258.00	258	1
1998	7	JP8	149.4	230	254.44	254.67	273	57
1998	8	JP8	262.3	251	271.53	269.01	291	204

In Region 5 (West Coast), there were 52 reports of fuel exceeding the 300°C maximum in 1998.

Histogram: No histogram for this property.

Table: Region 3 (Gulf Coast) produces product with the lowest average final boiling point.

Table 26

**Values of JP5 for Flash Point by Region**

(Volume in Millions of Gallons)

(Spec = 60°C min)

Year	Region	Fuel	Volume	Min	Avg	WtAvg	Max	Count
1995	3	JP5	55.5	60	62.34	61.93	65	33
1995	7	JP5	31.7	61	67.25	66.71	72	8
1996	3	JP5	308.9	60	62.04	62.04	65	111
1996	5	JP5	51.4	60	61.53	61.91	63	17
1996	6	JP5	22.7	62	62.33	62.44	63	3
1996	7	JP5	71.9	60	63.90	63.86	70	21
1996	8	JP5	39.6	62	62.88	62.83	65	8
1997	3	JP5	322.9	60	62.44	62.06	72	129
1997	5	JP5	210.8	60	62.63	62.76	69	74
1997	6	JP5	59.2	61	63.40	63.56	65	10
1997	7	JP5	55.8	61	65.42	65.42	73	19
1997	8	JP5	58.6	61	63.85	63.87	67	20
1998	3	JP5	310.8	60	62.48	62.33	71	125
1998	5	JP5	168.3	61	64.52	64.44	72	66
1998	6	JP5	24.1	64	64.40	64.42	65	5
1998	7	JP5	54.7	61	64.42	64.49	72	19
1998	8	JP5	57.9	43	62.73	63.30	66	15

All fuel procured met the specification limit for 1998.

Histogram: The mean values and the shape of the histogram have not changed from 1997 to 1998.

Table: Average Flash Points appear to be slightly increasing each year. Region 3 (Gulf Coast) provides the lowest average flash point product. The highest average flash point product comes from Region 7 (Europe).

Table 27

**Values of JP8 for Flash Point by Region**

(Volume in Millions of Gallons)

(Spec = 38°C min)

Year	Region	Fuel	Volume	Min	Avg	WtAvg	Max	Count
1995	1	JP8	2.9	40	52.80	52.39	63	30
1995	2	JP8	126.6	40	51.65	51.77	59	83
1995	3	JP8	451.5	38	50.73	50.22	63	316
1995	4	JP8	10.0	43	47.20	46.99	51	16
1995	5	JP8	239.3	44	49.52	50.52	63	154
1995	7	JP8	65.1	42	49.93	50.50	69	21
1995	8	JP8	97.4	38	41.01	40.69	46	118
1996	1	JP8	18.8	40	49.48	43.15	60	60
1996	2	JP8	191.4	42	50.66	50.88	66	148
1996	3	JP8	633.7	38	49.98	49.88	70	433
1996	4	JP8	84.9	38	44.80	44.52	64	96
1996	5	JP8	426.6	40	48.93	50.03	62	224
1996	6	JP8	37.3	43	45.71	45.62	51	7
1996	7	JP8	263.1	38	45.13	46.13	64	111
1996	8	JP8	176.0	38	41.99	43.70	50	152
1997	1	JP8	91.4	42	53.19	55.17	74	97
1997	2	JP8	214.0	41	53.39	53.05	66	306
1997	3	JP8	799.9	38	48.75	50.10	77	658
1997	4	JP8	53.3	38	44.53	43.11	63	86
1997	5	JP8	421.5	40	48.38	48.96	64	286
1997	7	JP8	261.0	39	46.57	46.86	63	92
1997	8	JP8	301.5	39	44.41	47.03	59	170
1998	1	JP8	123.6	46	53.13	52.11	67	150
1998	2	JP8	215.8	40	54.49	53.46	69	272
1998	3	JP8	976.1	38	49.77	51.04	72	871
1998	4	JP8	60.2	38	45.37	43.97	58	112
1998	5	JP8	434.6	40	45.56	47.88	66	284
1998	6	JP8	6.7	52	52.00	52.00	52	1
1998	7	JP8	149.4	40	47.69	47.52	60	57
1998	8	JP8	262.3	39	42.93	44.74	53	204

All fuel procured met specification requirements for 1998.

Histogram: No change in the shape of the histogram or the mean values. Product flashing above 60°C rose from 10.1% in 1997 to 13.3% in 1998.

Table: Region 4 (West Central) produces product with the lowest average flash point. Regions 2 (East Central), 3 (Gulf Coast) and 5 (West Coast) are major suppliers of product which meets the flash point requirements of JP5.



Table 28

**Values of JP5 for Cetane Index by Region**

(Volume in Millions of Gallons)

(Spec = Report)

Year	Region	Fuel	Volume	Min	Avg	WtAvg	Max	Count
1995	3	JP5	55.5	36.0	45.22	45.34	48.0	33
1995	7	JP5	31.7	41.1	44.54	44.66	46.0	8
1996	3	JP5	308.9	32.6	47.00	47.21	59.4	111
1996	5	JP5	51.4	39.0	42.66	43.16	47.1	17
1996	6	JP5	22.7	44.4	45.80	45.40	47.0	3
1996	7	JP5	71.9	40.8	44.30	44.32	47.5	21
1996	8	JP5	39.6	40.0	45.63	45.64	49.0	8
1997	3	JP5	322.9	44.3	47.43	47.58	49.1	129
1997	5	JP5	210.8	33.7	41.75	42.67	46.0	74
1997	6	JP5	59.2	42.4	44.21	44.14	45.2	10
1997	7	JP5	55.8	42.4	45.35	45.02	56.5	19
1997	8	JP5	56.6	39.5	44.08	43.73	49.0	18
1998	3	JP5	310.8	40.8	47.42	47.50	49.2	125
1998	5	JP5	168.3	32.3	38.93	39.45	44.0	66
1998	6	JP5	24.1	43.0	43.26	43.27	44.1	5
1998	7	JP5	54.7	41.4	45.70	45.43	48.0	19
1998	8	JP5	57.9	37.5	45.40	46.99	49.0	15

The cetane index is a report only requirement.

Histogram: The mean value decreased from 44.5 in 1997 to 43.7 in 1998.

Table: Region 3 (Gulf Coast) reported the highest average cetane indexes. Region 5 (West Coast) reported the lowest average values and the average shows a decreasing trend.

Table 29

**Values of JP8 for Cetane Index by Region**

(Volume in Millions of Gallons)

(Spec = Report)

Year	Region	Fuel	Volume	Min	Avg	WtAvg	Max	Count
1995	1	JP8	2.9	37.6	40.08	40.00	42.6	30
1995	2	JP8	112.8	42.3	44.77	44.82	47.0	76
1995	3	JP8	451.5	35.5	43.78	42.85	49.1	316
1995	4	JP8	10.0	39.0	43.49	43.76	45.6	16
1995	5	JP8	239.3	37.0	41.49	40.84	43.0	154
1995	7	JP8	65.1	34.0	42.95	43.97	47.0	21
1995	8	JP8	97.4	36.3	42.07	41.13	49.0	118
1996	1	JP8	4.5	37.3	41.09	41.27	44.9	49
1996	2	JP8	191.4	39.0	44.00	44.04	46.3	148
1996	3	JP8	633.3	35.7	43.67	43.28	56.0	432
1996	4	JP8	84.9	35.0	41.50	41.50	46.1	96
1996	5	JP8	426.6	38.0	40.83	40.84	45.0	224
1996	6	JP8	37.3	44.5	46.00	46.05	49.0	7
1996	7	JP8	233.6	37.0	43.50	44.16	52.0	89
1996	8	JP8	176.0	37.1	41.53	42.72	47.4	152
1997	1	JP8	91.4	37.7	40.88	41.48	45.0	97
1997	2	JP8	214.0	38.9	43.76	43.80	46.9	306
1997	3	JP8	799.9	32.8	42.02	41.54	49.9	658
1997	4	JP8	53.3	38.0	40.95	41.00	45.4	86
1997	5	JP8	411.7	35.0	40.65	40.42	49.5	284
1997	7	JP8	258.4	38.0	44.27	44.61	48.1	90
1997	8	JP8	301.5	35.3	42.22	45.07	59.3	170
1998	1	JP8	123.6	36.3	40.11	40.30	49.0	150
1998	2	JP8	215.8	38.0	43.81	43.42	46.9	272
1998	3	JP8	975.5	33.4	43.65	43.39	50.6	871
1998	4	JP8	60.2	36.1	42.96	42.52	47.0	112
1998	5	JP8	434.6	33.9	39.76	40.58	51.0	284
1998	6	JP8	6.7	42.5	42.5	42.5	42.5	1
1998	7	JP8	149.4	40.3	44.61	44.85	48.0	57
1998	8	JP8	247.4	33.5	41.82	45.02	51.6	199

The cetane index is a report only requirement.

Histogram: No change in the shape of the histogram or the mean values from 1997 to 1998.

Table: Region 1 (East Coast) has the lowest average cetane index. Regions 2 (East Central) and 3 (Gulf Coast) had the highest averages for cetane index.

Table 30

**Values of JP5 for Net Heat of Combustion by Region**

(Volume in Millions of Gallons)

(Spec Aniline-Gravity = 4500 min, Net Heat = 18300 BTU or 42.6 MJ/kg min)

Year	Region	Fuel	AG Min	AG Avg	AG Max	BTU Min	BTU Avg	BTU Max	MJ Min	MJ Avg	MJ Max
1995	3	JP5	5009	6048.8	6408	18557	18586.8	18608			
1995	7	JP5	5859	6367.1	6688						
1996	3	JP5	4899	6150.9	6525	18582	18582	18582			
1996	5	JP5	5224	5520.5	6014				41.6	42.78	43.1
1996	6	JP5	6086	6242.0	6398				43.4	43.39	43.4
1996	7	JP5	5894	6186.5	6658				42.2	42.99	43.3
1996	8	JP5							40.4	42.94	43.4
1997	3	JP5	5711	6217	6442	18431	18573.6	18615			
1997	5	JP5	4924	5397.0	6249				43.0	43.02	43.1
1997	6	JP5	5569	6066.3	6254						
1997	7	JP5	5710	6136.2	6600				43.2	43.22	43.2
1997	8	JP5	6480	6578	6650				43.0	43.20	43.3
1998	3	JP5	5577	6258.5	6575	18577	18583.2	18591			
1998	5	JP5	4784	5242.6	5755	18442	18465.3	18490	43.0	43.00	43.0
1998	6	JP5							43.1	43.11	43.1
1998	7	JP5	5575	6224.6	6728				43.2	43.28	43.3
1998	8	JP5	6810	6810	6810				43.0	43.27	43.5

The Net Heat can be reported in three different ways: the Aniline-API Gravity product or net heat reported in either British Thermal Units (BTUs) or in MilliJoules per kg (MJ/kg). No obvious trends are apparent.

Table 31

**Values of JP8 for Net Heat of Combustion by Region**

(Volume in Millions of Gallons)

(Spec Net Heat = 18400 BTU or 42.8 MJ/kg min)

Year	Region	Fuel	AG Min	AG Avg	AG Max	BTU Min	BTU Avg	BTU Max	MJ Min	MJ Avg	MJ Max
1995	1	JP8							43.1	43.14	43.2
1995	2	JP8	5913	6152.8	7352	18540	18612.9	18645	43.1	43.18	43.2
1995	3	JP8	5913	6273.8	6825	18523	18616.4	19188	42.8	43.21	43.8
1995	4	JP8				18557	18602.8	18632	43.2	43.22	43.3
1995	5	JP8	5828	6262.7	6396	18483	18523.2	18611	43.0	43.04	43.1
1995	7	JP8	5913	5913.0	5913				43.2	43.26	43.7
1995	8	JP8	5913	5913.0	5913	18514	18557.6	18689	42.8	43.24	43.4
1996	1	JP8							43.1	43.14	43.3
1996	2	JP8				18500	18609.8	18647	43.1	43.21	43.3
1996	3	JP8	6322	6357.0	6402	15585	18572.7	18950	43.0	43.23	43.4
1996	4	JP8				18544	18602.9	18649	42.8	43.17	43.2
1996	5	JP8	5857	6225.7	6913	15566	18505.6	18984	43.0	43.03	43.1
1996	6	JP8							43.3	43.37	43.4
1996	7	JP8	5571	5947.5	6283				43.1	43.23	43.4
1996	8	JP8	5665	5692.0	5719	15589	18502.1	18999	43.1	43.64	46.7
1997	1	JP8							43.1	43.20	43.4
1997	2	JP8				18504	18605.7	18725	42.8	43.49	44.0
1997	3	JP8				18503	18602.3	19605	43.0	43.23	43.7
1997	4	JP8				18539	18602.0	18646	43.2	43.29	43.4
1997	5	JP8	5819	6060.3	6258	18487	18547.4	18857	43.0	43.04	43.1
1997	7	JP8	5749	6148.0	6488	18601	18615.6	18648	43.1	43.32	45.5
1997	8	JP8				18505	18615.1	19646	43.2	43.49	45.0
1998	1	JP8							42.8	43.18	43.5
1998	2	JP8				18460	18591.6	18631	43.0	43.83	44.0
1998	3	JP8				18400	18598.0	18851	43.0	43.23	43.5
1998	4	JP8				18557	18600.7	18638	43.3	43.33	43.4
1998	5	JP8	5567	5954.3	6342	18451	18549.2	18634	43.0	43.05	43.1
1998	6	JP8							43.3	43.30	43.3
1998	7	JP8	6231	6399.8	6516	18596	18618.7	18634	43.0	43.27	43.4
1998	8	JP8				13750	18425.6	18674	43.2	43.35	43.8

The Net Heat can be reported either British Thermal Units (BTUs) or in MilliJoules per kg (MJ/kg). No obvious trends are apparent. Although the Aniline-Gravity product is not required for JP8, one refinery in Region 5 (West Coast) submitted 16 reports which contained both the Aniline-Gravity product and Heat Content in BTUs. One refinery in Region 7 (Europe) submitted 6 reports which contained both the Aniline-Gravity product and the Net Heat in MJ/kg. The values for the Aniline-Gravity product are reported for information only.

**Special Report on  
Jet Fuel Thermal Oxidation Stability Tester (JFTOT)  
Test Results for  
Test Temperatures of 260°C and 275°C  
1998 Data**

At the December 1998 ASTM Meeting, the issue of comparison of JFTOT results with the test temperature of 260°C and also at 275°C was discussed. In light of this discussion, the following charts are presented which represents JFTOT results for both JP5 and JP8 reported at each of the two test result temperatures. Test results were for only one of the test temperatures. Contractors were not required to report test results at both temperatures.

The military jet fuel specifications specify the temperature of the JFTOT test to be 260°C. However, our contracts require a JFTOT test temperature of 275°C with the same limits on the tube deposit rating (Less than 3 maximum) and on the pressure differential (25 mm Hg maximum). If the test fails at 275°C, the refiner can then perform the test at 260°C and report the results at 260°C. If the product fails the JFTOT at 275°C, it must pass the JFTOT at 260°C in order to be accepted. JFTOT test results are entered into the PQIS database with a Test Method code of "610" to indicate a test temperature of 260°C and a code of "610X" to indicate a test temperature of 275°C.

The next series of eight histograms display volume in millions of gallons versus the JFTOT test characteristic at a specified temperature. The following table indicates the number of test results for each product at each temperature:

*Table 32*

***JFTOT at 260°C and 275°C  
Number of Reports and Volume***  
(Millions of Gallons)

<b>Fuel</b>	<b>Test Temperature</b>	<b>Count</b>	<b>Volume</b>
JP5	260°C	80	190.0
JP5	275°C	150	425.8
JP8	260°C	346	577.5
JP8	275°C	1592	1559.4

For 1998, a tally of JFTOT test temperatures by contractor indicated that 9 out of 46 contractors (20%) performed the JFTOT test at 260°C, 31 out of 46 contractors (67%) performed the JFTOT test at 275°C and 6 out of 46 contractors (13%) performed the JFTOT test at both temperatures. Most of the jet fuel we procure can pass the JFTOT at 275°C.

Table 33 below shows the breakdown of the number of JFTOT test for JP5 and JP8 performed for each test temperature.

Table 33

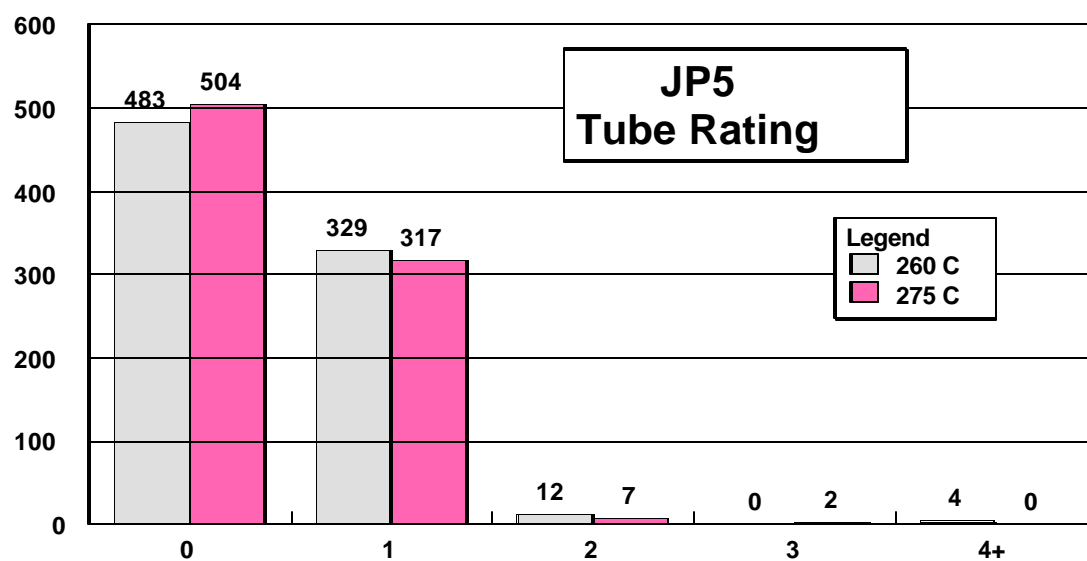
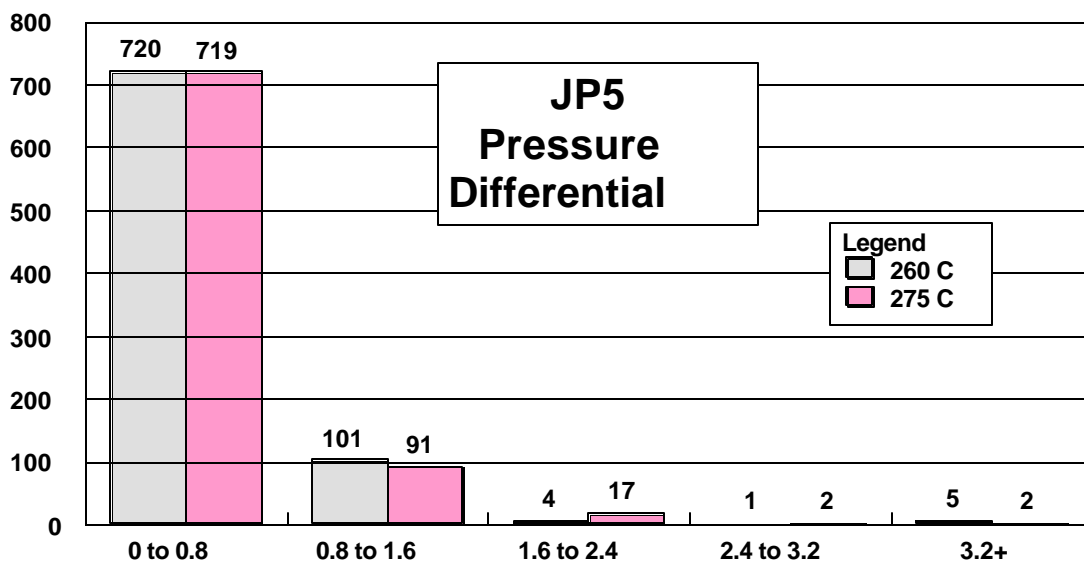
***JFTOT at 260°C and 275°C  
Number of Reports per Region***

<b>Year</b>	<b>Fuel</b>	<b>Region</b>	<b>Temp</b>	<b>Count</b>
1998	JP5	3	260°C	46
	JP5	3	275 °C	79
1998	JP5	5	260 °C	32
	JP5	5	275 °C	34
1998	JP5	6	275 °C	5
1998	JP5	7	275 °C	19
1998	JP5	8	260 °C	2
	JP5	8	275 °C	13
1998	JP8	1	275 °C	150
1998	JP8	2	260 °C	86
	JP8	2	275 °C	186
1998	JP8	3	260 °C	140
	JP8	3	275 °C	732
1998	JP8	4	275 °C	112
1998	JP8	5	260 °C	46
	JP8	5	275 °C	238
1998	JP8	6	275 °C	1
1998	JP8	7	275 °C	57
1998	JP8	8	260 °C	74
	JP8	8	275 °C	116

Refiners in Regions 1, 4, 6 and 7 perform the JFTOT test exclusively using the test temperature of 275°C. Refiners in Regions 2, 3, 5 and 8 perform the JFTOT test using both test temperatures. However, the test temperature used in the Regions performing both tests is 275°C the majority of the time. The exception is Region 5 for JP5, which is about 50-50. Region 5 encompasses states on the west coast.

## JFTOT Test Results for JP5

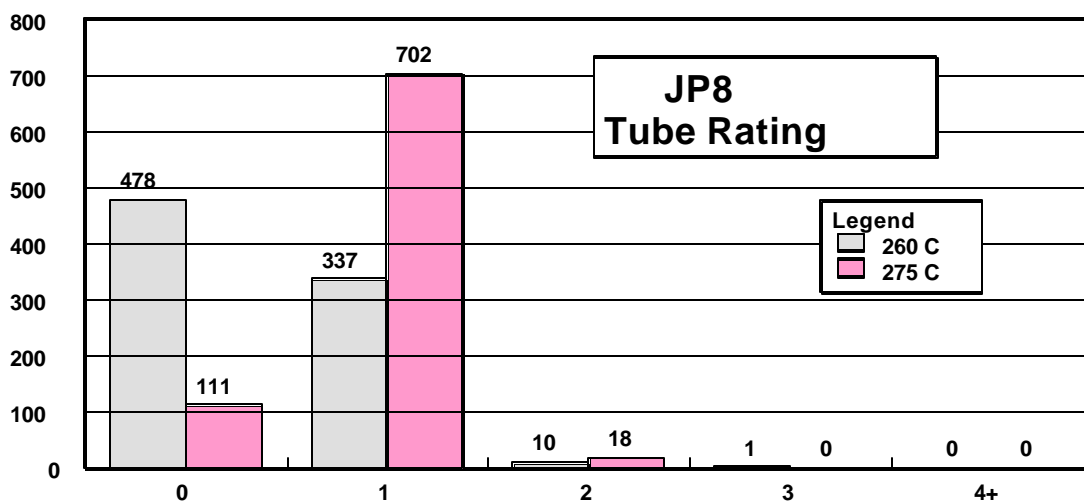
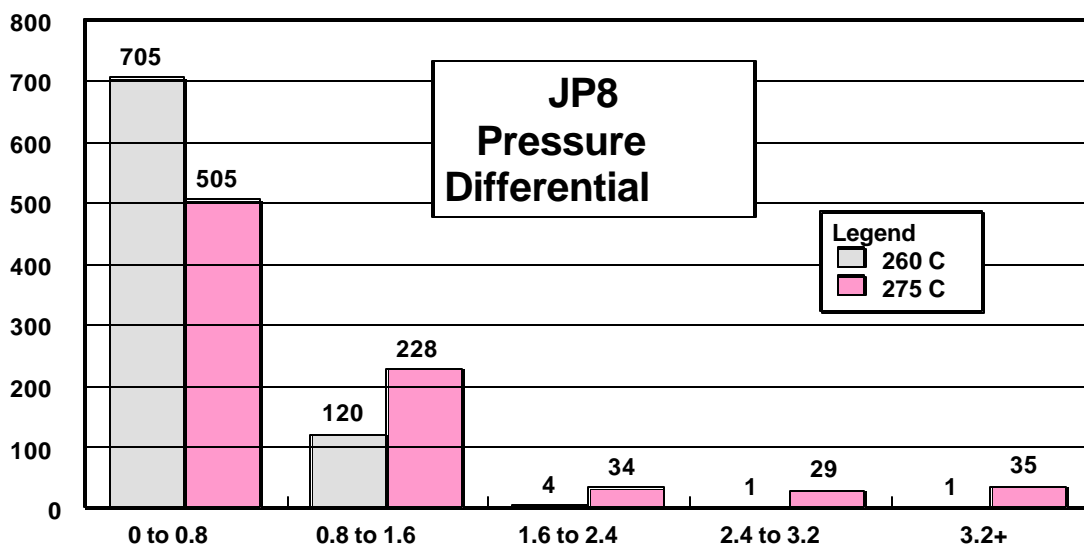
(Number of Reports)



The above histograms plot the number of reports versus either the JFTOT Tube Deposit Rating or the Pressure Differential for JP5. Pressure differential readings can be reported to the nearest 0.1 mm Hg. Both JFTOT test temperatures of 260°C and 275°C are shown. The JP5 data shows very little difference between results for each of the two temperatures based on number of reports.

## JFTOT Test Results for JP8

(Number of Reports)



The above histograms plot the number of reports versus either the JFTOT Tube Deposit Rating or the Pressure Differential for JP8. Both JFTOT test temperatures of 260°C and 275°C are shown. The JP8 data shows a shift in Tube Rating from “0” to “1” as the test temperature increases. Data for pressure differential shows a wider spread of data over a wider range for the test temperature of 275°C versus the 260°C.